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INTEGRATED PEST MANAGEMENT PROGRAMS. --

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ROLE OF USDA IN INTEGRATED PEST MANAGEMENT

The Department continues to contribute in a major way to the development and expansion of the concept of integrated pest management. It recognizes that a number of levels of integration are necessary to deal with the diversity of pest problems.

These levels of pest management include:

— The integration of several procedures against a single pest;

-- The integration of many methods against a complex of pests attacking a single commodity;

-- The integration of many methods against a complex of pests attacking a group of commodities; and

-- The integration of pest management systems into crop, livestock, and forest production and marketing systems.

A pest management system is an approach in which methods and materials are chosen to control pests while minimizing undesirable results. Pest management systems are used in major pest management strategies. With existing technology, the most frequently used strategy is to manage local pest populations, such as on a field-by-field basis. Other major strategies are prevention, area-wide management, or elimination of pest species from defined areas.

Since pest and their ecology vary greatly from time to time and from place to place, pest management systems must be flexible and allow for local adjustments in their applications.

A. Roles of Individual USDA Agencies

1. Science and Education Administration/Federal Research Unit.

The Federal Research unit is an in-house research arm of the USDA. Research is conducted extramurally when this is more efficienct than in-house efforts or when superior expertise resides outside the unit. Research on pests and on their management is conducted at roughly 100 locations in close cooperation with State agricultural experiment stations.

Federal Research defines a pest to be any organism which conflicts with the interest of man. For example, pathogens attacking livestock are viewed as pests.

Research on pests is conducted to directly support the following USDA missions:

a. Agricultural Production Efficiency.
b. Agricultural Marketing and Distribution.

c. Agricultural Exports.
d. Environmental Improvement and Resource Development and Use.
e. Consumer Services and Human Resource Development.
f. Foreign Agricultural Development.

Program Structure

The Science and Education Administration/Federal Research, National Research Programs (NRP's) provide the "blueprints" for the ongoing and planned effort. In addition, Special Research Programs (SRP's) have been established for activities that cut across NRP's.

Legislative Authority

SEA/FR functions under the authority of a) the Organic Act of USDA, 1862; b) Research and Marketing Act, 1946 (PL 79-732); c) Agricultural Trade Development and Assistance Act, 1954 (PL 83-690); d) Special Foreign Currency Act (PL 83-480), and Title XIV--National Agricultural Research, Extension, and Teaching Policy Act of 1977 (PL 95-113).

2. Science and Education Administration/Cooperative Research Unit.

This unit has no in-house research program. Instead, this unit administers a) funds appropriated for research under the Hatch Act to the State agricultural experiment stations; b) funds appropriated under PL 89-106 for special research; c) funds appropriated for the new Competitive Grants Program; d) funds for forestry research appropriated under Cooperative Forestry Research Act (PL 87-788); and e) construction funds under the Facility Act (PL 88-74).

3. Science and Education Administration/Extension Unit.

Under the Smith Lever Act, the Extension unit provides funding for the Cooperative Extension Service. The Cooperative Extension Service (CES) in each State is the off-campus educational arm of the Land-Grant University.

CES plays a key role in implementing the educational programs relating to all phases of pest control. Activities included are:

a. Training for certification of users of pesticides as required by the Federal Insecticide, Fungicide, and Rodenticide Act;

b. Providing pesticide recommendations as a guide to suppliers and users;

c. Serving as a source of information to community leaders, elected officials, industry, regulatory agencies, consultants, producers, and the general public; and

d. Implementing pest management programs.

CES has several additional roles in the broad area of IPM. These include:

a. Explaining the concept of IPM to users and to the public;

b. Providing training for growers, industry representatives, and consultants; and

c. Implementing programs.

The implementation of IPM is largely an educational process for many pest problems, and the land-grant university with its interacting programs of teaching, research, and extension is well qualified to provide the needed leadership.

In 1972, the CES initiated pilot application programs in pest management. The rationale underlying these projects was:

a. The application of existing knowledge could result in reduction in use of pesticides with savings to growers;

b. That this could be demonstrated to growers; and

c. Once demonstrated, growers would be willing to share in the cost of these programs.

The initial effort in 1972 involved two projects, one in Arizona on cotton insects, and the other in North Carolina on tobacco insects. In 1973, 3-year pilot application projects were initiated on cotton in 14 States. These programs have been expanded to include corn, soybeans, rice, peanuts, tobacco, wheat, grain sorghum, alfalfa, potatoes, vegetables, citrus, pears, apples, peaches, and pecans. By 1976, 33 States were participating in 38 projects with funding of $2,885,000. In fiscal year 1978, all States were funded at not less than $25,000 of Federal funds with a maximum of $115,000 to States with the greatest pesticide use. While projects must meet USDA guidelines, they can be on commodities and pests selected by the individual States.

The ultimate objective of the pilot application program has been to provide education and technical assistance rather than to provide farmers with individual services. Pilot application programs that were extended beyond the original 3-year period have required that growers pay direct costs of scouting fields.

4. Animal and Plant Health Inspection Service (APHIS).

APHIS deals with a variety of plant protection and quarantine programs and with various veterinary services. Plant protection and quarantine programs include:

a. Environmental evaluation of the impacts of pest management programs (this includes monitoring of pesticide residues);

b. Treatment of imported and exported commodities;

c. Detection of new pests and surveys of insects and diseases throughout the United States;

d. Regulation of the importation of plants and operation of quarantine facilities for imported plants;

e. Inspection of imports from abroad to intercept new pests;

f. Quarantines and action programs to prevent or retard the spread of established exotic pests (gypsy moth, boll weevil, pink bollworm, witchweed, etc.), and eradication of incipient infestations; and

g. Production and distribution of certain parasites (e.g., against cereal leaf beetle) and production and release of sterile males (e.g., tropical fruit flies).

Veterinary services programs include:

a. Eradication of serious livestock and poultry diseases such as brucellosis, scabies, etc.;

b. Area-wide management of screwworm in Mexico to prevent invasion of the U.S.; and

c. Licensing of vaccines and other biologics and establishment of standards.

APHIS works very closely with local, State, national, foreign, and international agencies. APHIS focuses on pest problems that cannot be adequately handled by individuals or local and State governments. SEA/FR is the main source of APHIS's technology.

5. Agricultural Stabilization and Conservation Service (ASCS).

ASCS is involved in a limited and indirect manner in the management of weed populations. Thus, through the Agricultural Conservation Program (ACP), ASCS provides cost sharing of conservation practices with farmers and ranchers throughout the U.S. For example, improving vegetation cover may be accomplished through cultural and chemical measures and the seeding of highly competitive grasses and legumes.

The Emergency Preparedness Divison determines pesticide requirements for adequate agricultural production of quality food, feed, and fiber in event of national defense emergencies. This Division annually issues a collation of information on pesticide and pest management in "The Pesticide Review."

6. Soil Conservation Service (SCS).

This Service conducts a pesticide monitoring program as part of the program on water quality. As part of this effort, pesticide residues in fish are determined.

SCS also provides technical assistance in weed management to owners and operators of non-Federal lands. This largely involves management of woody plants on grazing lands with native vegetation. SCS is also involved in monitoring pesticide residues.

7. Federal Crop Insurance Corporation (FCIC).

FCIC provides insurance on most field crops on an all-risk basis. The program is designed to guarantee the producer the return of production costs. The program does not provide insurance for poor farming practices or neglect of the crop. Considerable indemnities have been paid for losses caused by pink bollworm, western corn rootworm, and other pests. The all-risk program is administered through the use of ca. $12 billion annual appropriation and an additional ca. $9 billion of premium income.

8. Economics, Statistics, and Cooperatives Service (ESCS).

The Economic Research Unit has been involved since 1964 in the collating of data on pesticide usage and on analyzing the costs and benefits of such uses. In FY 1979, this unit has initiated research to facilitate the implementation of integrated pest management systems.

The Statistics Unit collects data on losses caused by a limited number of pests such as the European corn borer.

The Cooperatives Unit has been effective in facilitating the organization of cooperatives which provide pest management services.

9. Farmers Home Administration (FmHA).

This Agency provides a limited number of loans to farmers whose crops have been destroyed by pests provided that appropriate efforts were made to protect the crop and provided that weather played a substantial role in the pest outbreak.

10. Forest Service (FS).

FS has a substantial program of research on managing insects, diseases, and vegetation. This research is conducted in-house and extramurally. Legislative authority for FS research is based largely on the McSweeney-McNary Foreign Research Act of 1928, as amended and supplemented, authorizes in-house research at forest experiment stations and cooperative research.

FS guards the National Forest System against serious pest outbreaks. Further, FS is intimately involved in State and private forestry. Thus, FS cost shares the management of insects, diseases, and undesirable vegetation in State and private forests.

11. Food Safety and Quality Service (FSQS).

FSQS is involved in safeguarding the human food supply from microorganisms that cause human illness and from residues of pesticides, antibiotics, and other contaminants and additives which may be hazardous to people. Poultryborne diseases such as salmonellosis and ornithosis are examples of concern. Meat inspection includes monitoring of residues of pesticides, antibiotics, growth regulators, and other additives or contaminants.

12. Agricultural Marketing Service (AMS).

Under the Federal Seed Act, AMS regulates the importation of crop seeds contaminated with weed propagules. Also, AMS prohibits the shipment of crop seed into a State with a higher level of weed seed contamination than permitted by the laws of the State. This is preventive weed management. AMS does not regulate the shipment of seed contaminated with seedborne diseases or insects.

UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF THE SECRETARY

WASHINGTON, D. C. 20250

December 12, 1977

SECRETARY'S MEMORANDUM NO. 1929

U.S.D.A. Policy on Management of Pest Problems

olicy. It is the policy of the U.S. Department of Agriculture to develop, ractice, and encourage the use of integrated pest management methods, ystems, and strategies that are practical, effective and energy-efficient. he policy is to seek adequate protection against significant pests with he least hazard to man, his possessions, wildlife and the natural environ- ent. Additional natural controls and selective measures to achieve these oals will be developed and adopted as rapidly as possible.

asis for Policy. A principal mission of the Department is to assure an dequate supply of high quality food and fiber and a high quality environ- ent for the American people. The success of this mission is continually hallenged by pests, such as insects, bacteria, fungi, viruses, weeds, ematodes, snails, slugs, birds, rodents and other organisms.

These pests adversely affect production, preservation and use of ood, feed, and fiber; public health; marketing; domestic and wild animals; he quality of soil, water, and air; and recreation and esthetic values. ontrol of pests is essential to the Nation's agricultural production, verall commerce and public health. Yet, pest control can deliver un- esirable as well as desired effects.

How pests are controlled affects not only agriculture, forestry and atural ecosystems, but those who utilize their products, the consumers.

Reliance on a single pest control method does not always provide asting protection. A desirable approach is to select, integrate and use ethods on the basis of anticipated economic, ecological and sociological onsequences. This approach is called integrated pest management.

Effective integrated pest management has to be an integral part of he overall management of a farm, a business, or a forest. A thorough nderstanding of these complex operations can be accomplished by the ystems approach. This approach takes full account of economic losses, isks to human health and safety, the environment, energy requirements nd damage to those organisms that we do not want to affect.

The methods of integrated pest management can best be fit together ith a systems approach. Highly desirable components of many integrated est management systems include the use of diseases, predators, and arasites that attack pests; the use of sterile insects that suppress

duction of pests; and resistant plant varieties and livestock breeds. also include cultural practices in raising crops, habitat management, pro- on of wildlife, attractants that divert and entrap pests, repellents and tive pesticides. Since some of these methods may be potentially hazardous her than the pests, they should be evaluated carefully before and after ion.

The Department continues to contribute in a major way to the development xpansion of the concept of integrated pest management. It recognizes a number of levels of integration are necessary to deal with the diversity st problems.

These levels of pest management include:

-- The integration of several procedures against a single pest;

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A pest management system is an approach in which methods and materials chosen to control pests while minimizing undesirable results. Pest manage- systems are used in major pest management strategies. With existing nology, the most frequently used strategy is to manage local pest popu- ons, such as on a field by field basis. Other major strategies are pre- ion, area-wide management, or elimination of pest species from defined areas.

Since pests and their ecology vary greatly from time to time and from e to place, pest management systems must be flexible and allow for local stments in their applications.

ementation of Policy. The Department recognizes the need to speed the lopment and use of reliable integrated pest management practices. Current rtment programs include basic research on biological principles and esses; research and development on control methods and systems; monitoring populations; and the integration, demonstration and evaluation of effective management systems in production, marketing and resource management ctices.

USDA research, regulatory, educational, and financial assistance re- ces will be directed to carry out this pest management policy. The USDA k Group on Pest Management will review and advise on the implementation the Department's policy on pest management.

Furthermore, the Department will:

-- Give special emphasis to the development and use of efficient and environmentally acceptable integrated pest management

systems. It will select all methods including pesticides for use in its pest management programs on the basis of their appropriateness and relative safety;

-- Conduct and support cooperative research on: (1) development and use of resistant crops and livestock, beneficial organisms, cultural methods, selective biological and chemical pesticides, other innovative methods, and systems for integrating these elements; (2) basic and theoretical biology of pests to stimulate innovations potentially useful in managing pests; and (3) the economics of pest management methods, systems and strategies including research on the feasibility of insurance against risk of losses;

-- Conduct cooperative projects which demonstrate the latest in pest management technology and expand pest management education and technical assistance for homeowners, farmers, ranchers, and woodland owners;

-- Improve coordination among Departmental agencies with other federal, state, and private organizations and agencies, and with interested people and groups to develop and encourage the use of pest management systems;

-- Assist the Environmental Protection Agency and industry in facilitating the development and registration of selective pesticides needed in pest management programs.

In carrying out its pest management policy, the Department will be mindful of the interests and needs of all segments of society, including those interested in households, gardens, small farms, commercial farms, forestry, food and fiber handling, transportation, storage, and marketing enterprises.

The Department, in its involvement with other countries in pest management, will be guided by the same concerns and policies as those which guide its domestic programs.

Secretary of Agriculture

IPM PROGRAMS OF USDA AGENCIES

EXECUTIVE SUMMARY

FOREST SERVICE PROGRAM FOR INTEGRATED PEST MANAGEMENT (IPM)

Integrated Pest Management (IPM) may be defined as a comprehensive systems approach to achieving resource management goals through the use of economical pest control in an environmentally sound manner. The objective of IPM is to optimize pest control in terms of overall economic, social, and environmental values. The basic strategy of an IPM system is to develop environmentally sound components; reduce the reliance on potentially hazardous chemicals; manage the resource involved in a manner less conducive to pest problems; pilot-test and demonstrate the effectiveness of various new systems; provide needed training, education, and technology transfer; and encourage acceptance of workable, practical systems. The underlying principle of IPM is that the important component of the system is not the target organism itself but the resource to be protected.

The Forest Service is responsible for managing forest resources on over 187 million acres of National Forest lands and, working through the appropriate State agencies, for providing technical and financial assistance for the management of about 600 million acres of State and private forest lands. Through its comprehensive research and development program, the Forest Service also provides much of the technology needed to meet this Nation's demands for forest resources in the future.

Forest Insect and Disease Management.--The concept of integrated pest management has been the foundation of the Forest Service's insect and disease management operational program for many years. The major components of this program are prevention, detection, evaluation, and suppression. Detection and evaluation surveys are conducted annually by Forest Service specialists on approximately 600 million acres of commercial forest land in the United States. In addition to these activities, the Forest Service provides technical assistance and training to Federal, State, and private land managers in insect and disease management, new methodology and techniques, environmental coordination, and environmental monitoring. In fiscal year 1979 the Forest Service plans to conduct a survey and technical assistance program on 630 million acres; 26 suppression projects on Federal, State, and private lands; 35 pilot control, survey and method improvement, and loss-assessment projects; and 7 demonstration projects at a total cost of $20.5 million.

Vegetation Management and Animal Control.--The Forest Service vegetation management activities are primarily integrated into the range, wildlife, and timber management and rights-of-way maintenance programs. These include noxious weed control, rangeland improvement, and animal

Prevention.--The prevention of intolerable losses caused by pests is a key ingredient in the Forest Service IPM program. The primary techniques used are silvicultural, designed to increase tree vigor and thus lessen tree or stand susceptibility to insect and disease damage. Other methods utilized include pesticides; behavioral chemicals; the planting of genetically resistant trees; the removal of high-risk trees; the removal of slash, cull logs, slabs, and other debris; biological agents; and many others.

Detection.--Detection is the early discovery, identification, and reporting of damaging insects, diseases, and environmental stresses. This is done by field-going personnel in conjunction with their other tasks and planned aerial and ground surveys by professional entomologists, pathologists, and technicians.

Evaluation.--Evaluation involves the gathering, analysis, and interpretation of technical data to provide a sound base for the development of alternatives and making decisions. This is mainly a decisionmaking process used to determine if prevention or suppression of insects and diseases is needed and the expected results of alternative strategies. The four main types of evaluations are: biological, environmental, economic, and loss-assessment. A biological evaluation is an appraisal of the current and potential significance of an insect or disease outbreak and the likely course it will take if not checked, the probable damage and loss to be expected if not suppressed, the probable reduction in damage and loss by suppression, and an indication of the most effective measures for suppressing the outbreak. The environmental evaluation considers the anticipated impacts of insects and diseases on the forest and the environment if no suppression is undertaken and for each alternative suppression method. The economic evaluation appraises the economic feasibility of alternative suppression methods, and the loss-assessment evaluation measures the annual insect- and disease-caused losses to determine the trend of growth loss and mortality.

Suppression.--Suppression is the action taken to reduce or prevent unacceptable losses due to insects and diseases and to maintain forests in a productive condition. As in prevention a broad range of tools are available to be used in a fully integrated system designed by trained professionals. These tools or techniques include the use of cultural and mechanical methods, behavioral chemicals, biological agents, solar heating, trap trees, pesticides, prescribed fire, and many others.

Training.--Training of Federal, State, and private forest land managers is an integral part of the forest insect and disease management program. Training programs stress the significance of cultural practices in preventing or alleviating the impacts of insects and diseases on the forest resource and all its related uses and values. Training is also important to enable land managers to recognize insect and disease outbreaks in their early stages so that timely prevention and suppression methods may

be taken to prevent or suppress outbreaks. Members of ground, aerial, and remote-sensing survey teams must be trained in the identification of damage symptoms, recognition of tree species, principles of mapping, and use of various data recording devices.

The Forest Service's technology transfer efforts have greatly increased in the past several years. The Department's Combined Forest Pest R&D Program and the Canada/USA Spruce Budworms R&D Program have developed new technology on the ecology of forest stands. This includes information on insect parasites and predators; microbial and behavioral chemicals; the biology of pests; determination of pest impacts; prediction of changes in pest populations; and suppression methods of pests by environmentally acceptable, biologically sound, and economically practical management tactics and strategies. Other Forest Service, university, and industrial research organizations are constantly developing new methodology and techniques which must be transferred to the land managers and other user groups as rapidly as possible so that they may implement these into forest management practices.

To this end the Forest Service has designed and implemented a number of pilot projects, method and survey improvement projects, and loss-assessment and impact projects. It has also established demonstration areas to evaluate how effective and efficient the new materials, techniques, and strategies may be before they are utilized on an operational basis. A number of demonstration areas are being established for an on-the-ground display of insect and disease management techniques which are used for training or demonstration purposes. In addition, Forest Service personnel are writing and distributing insect and disease publications for technical and popular articles for journals, newspapers, and magazines. They are also preparing slide-tape programs; sponsoring and attending workshops, seminars, training sessions, and symposia; preparing radio and T.V. spots; and providing technical assistance to land managers.

VEGETATION MANAGEMENT AND ANIMAL CONTROL

The Forest Service vegetation management activities are primarily integrated into the range, wildlife, and timber management and rights-of-way maintenance programs. These include noxious weed control, rangeland improvement, and animal control programs in the range and timber management programs; habitat manipulation, including aquatic weed control, in the wildlife management program; and site preparation and timber stand improvement work in the timber management program.

As a part of its wildlife management program, the Forest Service has a policy regarding the retention of snags needed to provide the habitat to maintain viable self-sustaining populations of cavity-nesting and snag-dependent wildlife species. Since the majority of the affected wildlife species are insectiverous birds or raptors, this practice provides

important natural control for many injurious insects and rodents. The retention of snags requires careful coordination with other management activities--such as timber management, fire management, and safety. Greater efforts will be needed as the demand increases for the use of dead and dying trees for commercial purposes, energy, and firewood.

Predator control on the National Forest lands is aimed primarily toward reducing livestock losses of permittees. However, predator control is sometimes advocated to meet wildlife objectives. This use could increase in the future when threatened or endangered species are involved.

The Forest Service policy in predator control is:

> All forms of native wildlife have a place in National Forest System lands. Control will be instigated when populations threaten public safety, health, or threatened or endangered species or cause or threaten to cause excessive damage to other resources.

The Fish and Wildlife Service, Department of the Interior, normally conducts predator control operations on the National Forest land. The Forest Service works with the Fish and Wildlife Service and the responsible States primarily in the planning phase but does not participate directly in the control work. Under this system Forest Service expenditures in time and money are minimal when compared to those of the Fish and Wildlife Service.

In order to achieve Forest Service and State objectives in fish management, trash fish must sometimes be removed from certain bodies of water. Although this can be accomplished in several ways, it is generally done with the use of Rotenone. State fish and game agencies normally remove trash fish on National Forest lands. The Forest Service cooperates with the States, particularly in the planning phase. Although some of this activity is carried out yearly on National Forest lands, it is not a common practice. Forest Service expenditure of time and money in this activity is very limited.

Establishment of new timber stands also requires protection from certain animals, such as rodents and deer in some areas. Population levels and/or forage or use patterns are manipulated through the use of pesticides, silvicultural techniques and practices, or a combination of both in programs coordinated with the Fish and Wildlife Service and State agencies.

ENVIRONMENTAL COORDINATION AND MONITORING

Environmental Coordination.--Just as IPM includes a process where all aspects of a pest/host system are studied and weighed to provide the

resource manager with an information base for decisionmaking, the Forest Service also uses an interdisciplinary approach to environmental assessment and decisionmaking.

The Forest Service guidelines for implementing the National Environmental Policy Act require detailed statements on proposed major Federal actions significantly affecting the quality of the human environment. This includes preparation of environmental assessments for pest management programs and activities affecting resources; other land uses; and the quality of the physical, biological, economic, and social environment.

Assessments are documented in either environmental assessment reports or environmental statements. These documents must present a clear, concise, and logical explanation of the need for the action; the criteria for evaluation of alternatives; the alternatives; the anticipated effects of implementing the alternatives; and, usually, the preferred alternative.

This process—through the systematic, interdisciplinary approach—identifies the pest management options which will have the least adverse impact on the quality of the human environment.

Environmental Monitoring.—Environmental monitoring encompasses all activities that evaluate effectiveness of pest management programs, including adherence to project plans and contamination of nontarget areas or organisms. Generally, such monitoring is restricted to situations where pesticides are used; however, it also applies to other components of IPM programs as well.

Environmental monitoring can be divided into two broad categories, residue and biological effects. Residue sampling is used to measure the accumulation, movement, and degradation of a pesticide following introduction into an environment. Significant degradation products, as well as the parent compound, are monitored.

Biological monitoring measures the effect of a pesticide application on nontarget organisms or their environment. Representative key nontarget organisms are normally selected. These include birds, small mammals, fish, aquatic insects, and parasites and predators of the target pest. Environmental monitoring is the basis for determining and quantifying the presence or absence of environmental effects due to pesticide application.

RESEARCH

Overall Forest Service research is oriented to the management, protection, and use of timber, water, forage, wildlife, and recreation resources of forest and rangelands. It employs biological, physical, economic, and social sciences to solve complex problems of forest and range management and forest products utilization.

Development of integrated pest management systems is primarily geared to insect and disease problems, but vegetative management is also an important concern. Research activities listed on the following pages reflect this concern and are most related to insects and disease with support from research in timber management, forest products and engineering, forest resource economics, and forest environment.

To develop the integrated pest management systems, research is required into the various components that make up the systems. Thus, three areas of research are emphasized. The first is development of knowledge and technology to define, measure, and evaluate the impact of forest pests. The second is the development of methods to detect, evaluate, and predict changes in occurrence of pests. Finally, the research develops methods to reduce the number and impacts of pests to tolerable levels by means of control techniques and management strategies that are economically and environmentally acceptable. All of the above research is conducted in full recognition that resultant pest management strategies must support and fit into overall forest and range management strategies.

IMPLEMENTATION OF THE USDA POLICY MANAGEMENT OF PEST PROBLEMS (Secretary's Memorandum No. 1929)

The Forest Service has previously used individual segments of an IPM program in its forest insect and disease management activities and has begun the development and implementation of a systematic approach. The Forest Service budgets and programs of work now give greater emphasis and consideration to the prevention of insect and disease problems in timber management planning, preparation of timber stand prescriptions, and compartment analyses. Forest insect and disease management specialists are becoming more involved in the planning stages of forest management and land use plans--including the resource components of timber, recreation, range, wildlife, watershed, and fire.

Cultural Practices.--The Forest Service has developed and implemented integrated pest management guidelines for bark beetle outbreaks in the West and South. Practices now utilized include the removing of high-risk trees, thinning stands to improve tree vigor, promptly salvaging beetle-infested trees, disposing of logging residue harboring beetles that threaten living trees, and promptly harvesting damaged or wind-thrown trees to prevent beetle buildup and the subsequent infestation of living trees. The use of a risk-rating system to identify and remove susceptible trees has substantially reduced losses caused by the western pine beetle in ponderosa pine. A risk-rating system has been developed for dwarf mistletoe-infected stands. Trees or stands with a high risk are sanitized by thinning to remove the moderately to heavily infected trees. Risk-rating systems are now being pilot-tested for the spruce budworms, mountain and southern pine beetles, and the gypsy moth. The

Forest Service has also developed guidelines for cultural practices which reduce stand susceptibility to attack by bark beetles. Research scientists have found that the intensity of bark beetle outbreaks is related to stand vigor. By maintaining optimum stand density, losses caused by the mountain pine beetle, southern pine beetle, and western pine beetle can be greatly reduced.

Silvicultural methods--including sanitation thinning, pruning, burning, and special regeneration systems--are used solely to suppress dwarf mistletoe, the most damaging disease of western conifers.

Certain cultural procedures can greatly reduce regeneration insect and disease problems. Cultural practices used in nurseries include managing irrigation practices, improving soil fertility, regulating seedling density, taking advantage of natural exposure, and removing nearby alternate hosts. The use of a weather forecasting system to inform nurserymen when conditions are favorable for rust infection minimizes fusiform rust losses in pine seedling nurseries and greatly reduces pesticide use and cost. The use of proper timing between lifting, fallowing, and planting reduces white grub damage in nursery beds.

Genetic resistance to insects and diseases is one of the most effective methods in an IPM program. Pine seedlings resistant to fusiform rust, white pine blister rust, and brown spot needle blight are now available for outplanting. Screening of disease-resistant seedlings is continuing, however, to discover better and faster growing varieties and progenies for release to land managers.

The Forest Service is operationally screening southern pines for resistance to fusiform rust and brown spot needle blight at its Bent Creek, North Carolina, Disease Resistance Screening Center. This unit screens about 500 to 1,000 approved seedlots annually. The screening of western white pine and sugar pine seedlings for resistance to white pine blister rust is done at the Dorena, Oregon, seed orchard. Seedlings at both installations are artificially innoculated with fungus spores, and the ones showing rust resistance are outplanted in seed orchards and used in reforestation.

Chemical and Biological Practices.--The use of conventional pesticides continues to offer opportunities for prevention or reduction of damage from insects and diseases. The amount of direct chemical control of forest insects and diseases has been declining in recent years. With the discovery of new, effective biological control agents, these are being substituted in aerial applications. The use of behavioral chemicals, which influence mating or attack behavior, is still in the experimental or pilot-testing stage. These types of materials include confusants, inhibitors, attractants, and repellents.

Biological agents, such as microbial insecticides, which are harmless to the environment, have also been developed and used. The most widespread is Bacillus thuringiensis (B.t.). B.t. gives good insect population reduction and excellent foliage protection for tent caterpillars, canker-worms, bagworms, and spanworms. With good coverage and proper timing of spray application, B.t. is also effective against the Douglas-fir tussock moth, gypsy moth, and spruce budworm. However, results are often erratic. Continued research and pilot-testing of new strains, spray application techniques, dosages, and timing of sprays should soon make aerial application dependable.

Two nucleopolyhedrosis viruses have also been recently registered for use against the Douglas-fir tussock moth and the gypsy moth. These are the first two viruses to be registered for use against forest insects. Quantities of these materials are being produced now for small-scale operational use in the near future.

Internal and External Coordination.--The Forest Service has recently broadened the responsibilities of its Pesticide-Use Coordinating Committee to include integrated pest management. All of the affected Staff Units are represented on this Committee.

The Forest Service also works very closely with EPA, other Federal agencies, and industry in the development and registration of selective pesticides which are effective against the target organism(s) but provide minimal hazard to nontarget species.

FOREST SERVICE PROGRAMS FOR FISCAL YEAR 1979

Forest Insect and Disease Management.

Survey and technical assistance program	630,000,000 acres $9.9 million
Planned suppression projects (Federal, State, and private)	26 $8.7 million
Pilot projects (pilot control, survey and method improvement, loss-assessment)	35 $1.2 million
Demonstration projects	7 $0.7 million

Pilot Projects	Target Pest	Pesticide
1. Evaluate efficacy of B.t. and carbaryl for suppressing spring and fall cankerworms and B.t. and Sevin-4-oil for forest tent caterpillar.	spring and fall cankerworks	B.t. and carbaryl
	forest tent caterpillar	B.t. and Sevin-4-oi
2. Evaluate efficacy and cost of nucleopolyhedrosis virus (NPV) and sertifer virus for suppressing important forest insects.	Douglas-fir tussock moth gypsy moth European pine sawfly	NPV sertifer virus
3. Evaluate Orthene at various spray rates for suppression of spruce budworm.	eastern spruce budworm	Orthene
4. Evaluate effectiveness of establishing parasites for suppressing forest insects.	larch sawfly larch casebearer	parasites
5. Evaluate cultural prevention methods for suppressing insects and diseases.	mountain pine beetle southern pine beetle white pine blister rust	
6. Evaluate risk- and hazard-rating systems to identify trees of moderate to high risk for removal during silvicultural stand thinnings	mountain pine beetle southern pine beetle spruce budworm gypsy moth jack pine budworm red oak borer	
7. Evaluate loss-assessment and impact of important economic forest insects and diseases of commercial tree species in the United States	spruce budworm mountain pine beetle southern pine beetle gypsy moth Douglas-fir tussock moth seed and cone insects regeneration insects and diseases dwarf mistletoe annosus root rot root and butt rots air pollutants beech-bark disease	
8. Evaluate use of earth resources satellite to gather and analyze insect and disease damage data.	all insects and diseases	

Pilot Projects (continued)	Target pest	Pesticide
9. Evaluate and improve methods for aerial and ground spray applications of chemical and biological pesticides.		

Demonstration Projects:

1. Demonstrate the effectiveness of an integrated vegetative management approach to control mountain pine beetle in Colorado's Front Range.

2. Demonstrate the effectiveness of various thinning strategies to reduce mountain pine beetle losses and show stand effects in Montana.

3. Demonstrate the effectiveness of an integrated pest management system for control of the gypsy moth in New York.

4. Demonstrate the effectiveness of an integrated pest management system for control of the spruce budworm in Maine.

5. Demonstrate the effectiveness of preventive thinning to control spruce beetle attacks in high-value stands.

6. Demonstrate the effectiveness of the mycorrhizal fungus Pisolithus tinctorius on increasing pine seedling vigor, growth, and survival in nurseries and outplantings.

7. Demonstrate the effectiveness of operational thinning to various stand stocking densities to suppress dwarf mistletoe in true fir.

Technology Transfer:

1. Update and evaluate a computer-based literature retrieval system for the gypsy moth.

2. Write and publish 24 forest insect and disease leaflets.

3. Write a number of regional publications, brochures, and articles for technical and popular journals and magazines. These are distributed to all land managers, the public, and other user groups. Most efforts are joint between FI&DM and State, Federal, and extension cooperators.

4. Sponsor the National Pesticide-Use Coordination Workshop and cosponsor the National Urban Forestry conference.

5. A major effort which will be emphasized and highlighted in fiscal year 1979 by FI&DM will be insect and disease inputs into Regional forest resource and land use management plans. There is a multitude of new data and technology in addition to older information that is available to be incorporated into these plans for implementation by the land managers and landowners.

Vegetation Management and Animal Control.

Program	Treatment	Acres	Man-years	Cost (MS
Range management				
Noxious weeds	chemical	27,293	—	—
	mechanical	159	—	—
Subtotal		27,452	64.0	1,600
Rangeland improvement	chemical	13,728	7.0	241
	mechanical	13,440	6.9	512
	manual	750	1.5	22
	pres. fire	23,645	6.0	160
Subtotal		51,563	21.4	935
Animal control	chemical	15,000	4.0	162
Total		94,015	89.4	2,697
Wildlife management				
Habitat (species manipulation, including aquatic weed control)	chemical	11,208	—	—
	mechanical	4,500	—	—
	pres. fire	7,050	—	—
Total		22,758	19.5	1,137
Timber management				
Reforestation (site preparation) and timber stand improvement	chemical	195,654	—	—
	mechanical	177,867	—	—
	manual	426,882	—	—
	pres. fire	105,322	—	—
Screening of herbicides for use in forest tree nurseries	chemical	9,171	—	—
TSI on nonindustrial private forest land	all	150,000	—	—
Total		1,064,896	5,714.0	160,542
R-O-W maintenance	mechanical	60,000	48.0	2,100
GRAND TOTALS		1,241,669	5,870.9	166,476

*Does not include 13,358 acres of prescribed burning for disease control.

(In addition to Forest Service use, approximately 890,000 acres of linear and nonlinear rights-of-way for uses such as powerlines, reservoirs, canal and electronic sites are authorized on National Forest lands. It is estimated that less than 5 percent, about 44,500 acres, is subjected annually to some form of chemical treatment by permittees or grantees. Reporting time is insufficient for collection of data on manpower, costs, and kind o treatment for the total use area. It is expected, however, that the remot location and difficult terrain associated with the typical rights-of-way have required application of chemicals in most of the sites when treated.)

Research.

Current R&D	Problem Statement	Relation to IPM System	(Estimated) SY	$(M)
Forest Insect and Disease	Provide the knowledge and technology to define, measure, and evaluate the impacts of destructive insects and disease on forest resources and on wood in storage and use.	Provides data to evaluate the need for integrated pest management and provides means to identify control strategies to be used.	16.00	1,264
	Provide knowledge and technology to detect, evaluate, and predict changes in occurrence of insect and disease pests.	Provides essential information for choosing the appropriate level of control effort and scheduling of control tactics.	54.00	4,491
	Provide the knowledge and technology to reduce the number and impacts of pests to tolerable levels by means of control techniques and management strategies that are economical and environmentally acceptable.	Provides a selection of control tactics and strategies to fit the unique needs of each pest situation.	107.00	9,077
Southern Pine Beetle Accelerated R&D Program	Implement existing technology and develop new improved short- and long-range pest management approaches to suppress or reduce the incidence and severity of southern pine beetle outbreaks.	Provides information on impacts, population trends, stand susceptibility, stand manipulation, control tactics, etc., needed to develop integrated pest management system and improve forest management decisions.	1/	1,714 2/
Canada/USA Spruce Budworms Program	Provide safe and economical controls for spruce budworms and develop management strategies for budworm-susceptible forests.	Provides improved information and technology and a variety of action alternatives and guidelines for decisionmaking by resource managers in applying the elements of IPM.	1/	3,683 2/
		FIDR Subtotal	177.00	20,229

Research. (continued)

Current R&D	Problem Statement	Relation to IPM System	(Estimated) SY	$(M)
Forest Resource Economics	Cost-effective guidelines for gypsy moth control.	Development of guidelines for assessing economic impacts of gypsy moth damage as an aid to allocating control treatments.	0.75	75
		FRER Subtotal	0.75	75
Forest Products and Engineering	Develop basic knowledge of the mechanisms of biological, chemical, and physical degradation of wood for use in devising improved processes to preserve and protect wood in use.	Provides environmentally acceptable techniques and strategies for protecting wood in use from decay.	9.00	794
		FPER Subtotal	9.00	794
Timber Management	Development and comparison of alternative weed control methods such as herbicides, silvicultural techniques including prevention of weed problems, and other methods.	Provides a selection of one or more control tactics to fit the needs of managers when dealing with specific pest-wood situations.	9.00	887
	Effects of weed management on productivity of forest ecosystems.	Provides information to resource managers for choosing the appropriate level of control effort and consequences of that effort.	5.70	562
		TMR Subtotal	14.70	1,449

Research. (continued)

Current R&D	Problem Statement	Relation to IPM System	(Estimated) SY	$(M)
Forest Environment	Basic and theoretical biology of weeds.	Provides information needed for development of cultural controls and identifies when and where such controls are best used to minimize impacts on the total forest ecosystem.	4.00	395
	Environmental effects.	Provides data on the effects of control materials and tactics on the soil, water, and timber resource.	3.80	371
		FER Subtotal	7.80	766
		GRAND TOTAL	209.25 3/	23,313

1/ The SY figure is not available because the funds involved are allocated by Program Managers. Number of funded projects varies by year and within the year.

2/ Includes $754 M funded through SEA-Cooperative Research and funding grants of $278 M to Southeastern Area S&PF. The remainder of $1,714 M or $682 M supported research in SFES and SEFES.

3/ Grand total SY does not include those for southern pine beetle and spruce budworms programs. See footnote 1.

AREAS REQUIRING ATTENTION

Evaluation of Forest Pest Management Program.--Dr. Cutler has asked the Chief to initiate a thorough evaluation of the Forest Service's pest management program. The purpose of this study is to establish and examine the rationale for our present program direction and make adjustments where appropriate. The Forest Service has concluded that an evaluation of the pest management program could best be carried out using two separate studies. One study will address the insect-disease aspects of pest management. Under this study vegetation management practices will be examined as they pertain to insect and disease problems. The second study will address vegetation management practices as they relate to weed control, vegetative production, and plant competition.

Research.--(Title, Location, and R&D Activity)

FIDR	Environmental hazard of pesticides	Berkeley, CA; Research Triangle Park, NC

Increasing regulatory requirements of pesticide registration discourages private industry from conducting the necessary testing on environmental hazard needed for registration of minor use pesticides typical of most forestry uses. Research is needed to support label extensions of agricultural pesticides for forestry use and to support registration of selective, novel pesticides such as pheromones and insect growth regulators.

Research on environmental hazard would speed the development of vitally needed, safe pesticides to replace or supplement ones being, or likely to be, removed from use by EPA's RPAR process. This research would also assure the selection of the most environmentally sound materials for insect suppression.

	Insect and disease susceptibility on new genotypes	Athens, GA; Research Triangle Park, NC; and others

The increased use of improved pines in the reforestation of southern forests has included breeding and selection strategies intended to obtain high yield genotypes with resistance to environmental stress. However, research is needed on the question of relative insect and disease susceptibility among the improved pines.

Information on insect and disease susceptibility would permit selection of hybrids with greater resistance to environmental stresses and help to avoid future losses of expensive hybrid stands to insect and disease pests.

	Population dynamics of bark beetles	Alexandria, LA; Ogden, UT

Studies are needed on the complex interrelationships among bark beetle populations, natural enemies, associated microbes, and individual tree and stand characteristics. Population dynamics studies supported by such knowledge would make it possible to develop sound pest management strategies and tactics.

Role of disease and insects in plantation failures — Potential location—Moscow, ID

600,000 acres of cutover coniferous forest lands in the northern Rocky Mountains need to be reforested. Many of these acres have been planted in the past, some more than once, but the plantings have failed. We need to ascertain the reason for these failures. Disease and insect problems may be factors.

Growth reduction resulting from defoliation caused by diseases and insects

We need to quantify the growth reduction resulting from the loss of foliage (phytosynthetic tissue) due to diseases and insect feeding. We have the capability of measuring the amount of foliage loss, but at present we do not have the capability to translate this foliage loss into quantitative values of net photosynthesis, assimilation, and growth.

Effects of organic soil amendments on root rots

The most likely means for controlling populations of soil borne microorganisms that cause root rots of trees is by enhancing the populations of their soil borne antagonists. Organic soil amendments have been used successfull in agronomic crops for this purpose. We should examine such possibilities for forestry.

Interactions between bark beetles and root rots — University of California, Berkeley; University of Idaho, Moscow

Preliminary data, primarily from research conducted at two universities in the Western United States, indicate some very strong relationships between root rots and endemic populations of bark beetles. We need to strengthen our cooperation and become more directly involved in this research effort.

Control of drywood termites — Gulfport, MS; Honolulu, HI

Research on chemical controls is needed to provide options for control of drywood termites other than fumigation.

Research would provide new chemicals for safe and economical control of drywood termites. Presently, fumigation is the only available method and is very costly.

Canada/USA Spruce Budworms Program Various locations

Areas needing substantial continuing support from base funds, in addition to accelerated Program funds, include the following: population dynamics models that represent broad ranges of ecological parameters including site/stand characteristics, population quality, weather factors, and climate trends; stand prognosis models that represent broad geographic data bases; long-term economics of pest impacts on the full range of forest resource uses and values; forest management strategies directed toward prevention of budworm outbreaks, to include silvicultural prescriptions, harvesting strategies, and tree improvement; development of novel control materials including insect growth regulators and sex pheromones; development of biological materials including fungi (Entomophthora) and viruses; developmental work (not necessarily research) to provide more efficient aerial application technology; long-term assessments of environmental impacts of spruce budworm control action alternatives including chemical and biological insecticides and various forest management practices; realistic approaches to analyses of regional effects of spruce budworms management policies; technology transfer within the R&D investigative community and to resource managers expected to apply Program results.

FPER Improved processes to preserve and protect wood in use — Madison, WI

The development of new, effective, environmentally acceptable wood preservative treatments requires increased emphasis.

FER Environmental effects of use of pesticides on other control methods — Corvallis, OR

Continue to evaluate environmental effects of new chemicals as they are developed and other control measures.

Various locations

Most research of environmental effects of chemicals in the forest have been conducted in the Pacific Northwest. This could be expanded to other areas as there is apparently some concern as to whether these data are applicable to other parts of the country.

The Animal and Plant Health Inspection Service Approach to Management of Animal and Plant Pest Populations

The Animal and Plant Health Inspection Service (APHIS) has for many years been involved in the utilization of pest management practices in coping with plant and animal pest populations. Until recently, this fact has not been acknowledged. An example of this occurred in 1970 when APHIS ceased its "automatic" approach in preventing the westward movement of the cotton boll weevil onto the High Plains area of Texas. The new approach for this pest problem was to manage the pest population based on population density and location. Many other programs have incorporated pest management strategies into coping with pest populations. Another example is the use of information on exotic pest populations and biology of pests occurring in foreign countries plus application of pest risk analysis to affected commodities moving to the United States mainland in developing exclusion strategies for certain exotic plant and animal pests.

The capabilities and expertise of the APHIS programs in accomplishing its mission by management of pest populations are exerted in three major action systems and one supportive system. These systems are: (1) Exclusion (prevention) activities which prevent entry of exotic pests into this country and actions within the United States to prevent interstate spread of pests, (2) detection (surveillance) activities which detect new pests that have entered this country and the surveillance/delimiting activities involved with tracking newly

introduced and indigenous pests occurring in the United States, (3) intervention (action) activities directed against the pest, and (4) support actions in the area of environmental concerns and research and development. There are one or more substrategies or components under each of the above areas.

I. Exclusion Strategies

This activity involves three major substrategies. The first line of exclusion is international operations. This involves activity beyond the confines of the conterminous United States to provide intelligence on pest conditions, conduct pest risk analyses for commodities moving to the U.S. mainland, and to assist foreign countries in meeting U.S. import requirements. The second line of defense is inspectional activities and actions taken at ports of entry into the continental United States. The third area is prevention of spread within the U.S. by use of supportive regulatory action.

II. Detection Strategies

This strategy involves two major subsystems of action. The first activity is the detection of introduced plant or animal pests that have not been excluded from the United States. Additionally, this area involves the monitoring of indigenous pest populations that are of major economic significance. The second area involves the monitoring of pest populations for which APHIS conducts action programs. This supports both the exclusion and intervention strategies.

III. Intervention Strategies

This activity would involve actions to manage newly introduced and domestic plant pests to prevent artificial and natural dissemination of the pest organism. Management strategies such as suppression, containment, or eradication, or a combination would be employed. Management strategies would also be employed against those plant pests meeting APHIS criteria for Federal involvement and action.

IV. Support Strategies

This function involves all the support activities essential to the three action systems. Activities include environmental considerations (environmental impacts, pesticide registration, impact of endangered species, etc.) and research and development activities by APHIS and other Agencies.

In fiscal year 1979, APHIS will be involved in the improvement of its capability to manage certain pest populations as well as the initiation of activities against pests for which APHIS has not had a program.

New Program areas include:

Feasibility study on implementation of biological control program.

Implementation of a noxious weed management program.

Evaluation of eradication of three fruit flies from Hawaii.

Evaluation of eradication of the West Indian sugarcane root borer.

Evaluation of APHIS role in aquaculture--plant and animal.

Programs for which improved technology will be applied and evaluated.

Development of grasshopper pest management system.

Initiation of pest management approach on gypsy moth.

Expansion of exclusion activities.

Increase pest detection capability.

Development of a system for managing Japanese beetle populations at airports.

Evaluation of food attractants for screwworms.

Relationship of cattle and deer in managing the screwworm.

INTRODUCTION

The losses in agricultural production and marketing caused by pests are estimated at more than 30 percent. These losses are now valued at more than $20 billion annually. In addition, more than $10 billion are spent each year for the control of pests. Thus, the total losses in yield, quality, and marketing caused by pests and the cost of their control are now estimated to be more than $30 billion each year.

Pests not only adversely affect production and marketing. but they also impair the health of humans and domestic and wild animals; environmental quality including natural plant ecosystems, soil, water. and air; and recreation and esthetic values.

The management of pests is essential to the nation's agricultural production, overall commerce, and public health. Experience has shown that judicious pest control can have desirable effects, whereas nonjudicious pest control can have highly undesirable effects in agriculture and forestry. Also, nonjudicious pest control techniques can have unintended harmful effects, not only on nontarget species, but also on natural ecosystems and on the health and welfare of people. This realization led to an increased emphasis on a systems approach to pest management which is now known as integrated pest management (IPM).

IPM is the selection, integration, and implementation of pest control tactics in a systems approach on the basis of anticipated economic, ecological, and sociological consequences.

IPM is essential to achieving a major mission of the Science and Education Administration, development of the technology and transfer systems needed to assure an adequate supply of nutritious food, high-quality feed and fiber, and a quality environment. The success of this mission is continually challenged by pests such as insects, weeds, bacteria, fungi, viruses, nematodes, snails, slugs, birds, rodents, and other organisms.

The SEA and CU's allocate approximately $191 million annually in implementing research on pests and their control. These funds are allocated to achieve the following six major target objectives:

Target I. To gain knowledge of the fundamental biology of pests.

Target II. To improve current and develop new means of controlling pests by nonpesticidal methods.

Target III. To develop safer and more effective pesticide use patterns.

Target IV. To determine the toxicity, pathology, and metabolism of pesticides.

Target V. To evaluate the economic aspects of pest control and its impact on the environment.

Target IX. Information, extension, education, and coordination.

These funds are allocated as follows:

SUMMARY OF LEVEL OF EFFORT ON PESTS AND THEIR CONTROL
BY SEA AND COOPERATING UNIVERSITIES 1/

Agency	Pesticide Target I Funds	SY's	Pesticide Target II Funds	SY's	Pesticide Target III Funds	SY's	Pesticide Target IV Funds	SY's	Pesticide Target V Funds	SY's	Pesticide Target IX Funds	SY's
AR 2/	27,817,207	271.4	37,724,970	357.1	16,484,025	167.7	5,498,636	50.5	405,182	4.6	0.0	0.0
CR 2/	5,769,325	0.0	4,165,942	0.0	3,733,466	0.0	1,853,755	0.0	414,219	0.0	0.0	0.0
SAES 3/	18,273,800	305.8	18,087,455	268.5	15,148,365	226.4	5,498,035	79.9	1,136,630	13.6	0.0	0.0
E 2/	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4,435,000	0.0
CES 4/	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,774,000	325.0
TOTAL	51,860,332	577.2	59,978,367	625.6	36,365,856	394.1	12,787,426	130.4	1,956,031	18.2	6,209,000	325.0

1/ These funding levels do not include projects that are outside the scope of these six targets.

2/ Agricultural Research (AR), Cooperative Research (CR), and Extension (E).

3/ Includes SAES; Tuskegee, and 1890 Institutions; Forestry Schools. Includes non-Federal and other Federal funds adminstered by Cooperative Research.

4/ Cooperative Extension Service (CES). Professional SY's divided 47 percent State Specialists, 18 percent Area Agents, and 35 percent County Agency.

The overall program on pests and their control outlined above also contains the elements of the SEA IPM programs. The program on pests and their control emphasizes basic research, control components research, systems science research, and educational and informational delivery systems for technology on pests and their control. The purpose of this report is to describe the IPM portion of the overall program.

Effective IPM must be an integral part of the overall management of a farm, ranch, forest, or business. A thorough understanding of these complex operations can be accomplished best by the systems approach. This approach takes into full account the need to increase agricultural production, increase marketing efficiency, and to determine economic losses, risks to human health and safety, quality of the environment, energy requirements, soil and water conservation, and potential damage to those organisms that we do not want to adversely affect.

The elements of IPM can best be fit together with the systems approach. Highly desirable control components that are being developed from basic research include: the use of pest-resistant crop varieties and livestock breeds; the use of selective pesticides; use of diseases, predators, and parasites that attack pests; and the use of genetic and sterility methods that suppress reproduction of pests. Such systems also include ecological, biological, cultural, chemical, physical and mechanical practices for controlling pests in crops, habitat management, protection of wildlife, attractants that divert and entrap pests, and repellents.

For example, the IPM systems approach includes: the use of multiple-pest-resistant, high-yielding, well-adapted varieties that resist pest competition; precision placement of fertilizer to give the crop a differential advantage in resisting the competition of pests; and timing the fertilizer applications for maximum stimulation of the crop to enhance resistance to pests.

IPM systems also include: preplanting seedbed tillage. effective seedbed preparation, and seeding methods that enhance crop growth and minimize the competition of weeds and other pests with the crop; optimum plant populations per acre, including close spacing within the rows and close spacing between the rows to optimize crop growth and minimize the competition of weeds and other pests; and the use of crops that form a canopy for shading as early in the growing season as possible to discourage pest competition.

In addition, IPM systems include the use of judicious irrigation practices; timely and appropriate cultivations; sound crop rotation; crop diversification; field sanitation; harvesting methods that do not disseminate pests; and effective selective and safe chemical methods. For the IPM-directed agroecosystem approach to be most effective, preventive pest control technologies must precede and accompany IPM systems in order to reduce the recycling of pests in the environment.

Thus, an IPM system is an approach in which methods and materials are selected and combined to control pests while minimizing undesirable results. Pest management systems are used to implement major pest management strategies. With existing technology, the most frequently used strategy is to manage local pest populations, such as on a field-by-field basis. Other major pest management strategies are prevention, area or regionwide management of pests, and the elimination of pest species from defined areas, or take no action.

IPM requires several levels of integration to deal with the diversity of pest problems. These include: 1) the integration of several procedures to manage a single pest; 2) the integration of many methods against a complex of pests infesting a single commodity; 3) the integration of many methods against a complex of pests attacking a group of commodities; 4) the integration of pest management with other crop and livestock management systems; and 5) the integration of pest management systems into agroecosystems on farms, areas, and regions.

In the President's Environmental Message to Congress in 1977, he identified IPM as a high-priority program need. Subsequently, the Secretary of Agriculture issued Memorandum No. 1929 in which he established a "USDA policy on management of pest problems." Title XIV of the Food and Agriculture Act of 1977 mandates that research be conducted "to find solutions to environmental problems caused by technological changes in food and agriculture production," and to develop and implement through research. "more efficienct, less wasteful and environmentally sound methods for producing food."

Several organizations are considering the subject of IPM and developing recommendations to meet national needs. The Council of Environmental Quality (CEQ) is compiling a report entitled, "Integrated Pest Management-Status and Prospects in the United States." The Office of Technology Assessment (OTA) will soon propose its recommendations on IPM to the Congress in a report entitled, "Pest Management Strategies in Food Production." The Extension Committee on Policy (ECOP) has completed a report entitled, "Integrated Pest Management Programs for the Cooperative Extension Services" outlining a national strategy for implementing IPM programs. The Experiment Station Committee on Policy (ESCOP) is in the process of developing a comparable report on IPM for the state agricultural experiment stations.

Why must we strongly and decisively direct more of our resources toward the development of IPM? Why is it not sufficient to continue the approaches that we have used since World War II? Compelling answers to these questions exist but the problems differ markedly among the major disciplines that deal with diseases, insects, nematodes, and weeds.

These problems include: 1) a buildup of resistance of insects to insecticides and plant pathogens to fungicides; 2) excessive tillage for weed control that damages crop yields, causes undesirable ecological shifts in weed populations, increases soil erosion, impairs water quality and wastes energy; 3) a narrow genetic base in plants and animals that increases their vulnerability to attack by pests; 4) pesticide residues in the environment that should be reduced to the lowest practical level; 5) the need to reduce the nonjudicious and excessive use of pesticides, biological agents, and tillage practices; 6) and the obstacles faced by industry in developing new pesticides, especially insecticides, fungicides, and nematicides.

IPM can aid in reducing the impacts of these problems. If we fail to give adequate emphasis to IPM, we can expect a sharp increase in the number of serious pest, pesticide, and harmful environmental episodes.

To professionals in the disciplines of entomology, plant pathology, nematology, and weed science, "integrated pest management" is not merely a "buzzword," or a gimmick for soliciting funds. On the contrary, integrated pest management is the essence of the collective will, purpose, and broad strategy of these professions for coming to grips with the burden of pests on society.

GOALS OF IPM

The major goals of the SEA IPM Program are:

1. Reduce the losses caused by pests.

2. Reduce energy requirements and the escalating costs of pest control.

3. Reduce the hazards to the environment from pests and nonjudicious use of pest control methods.

4. Reduce the hazards to people from pests and nonjudicious pest control practices.

5. Improve the quality of the environment and the health and welfare of people.

The achievement of these major goals of the SEA IPM program will:

a. Improve the net profits of agricultural production and marketing systems by increasing efficiency and management effectiveness;

b. Reduce energy and high-cost labor, excessive tillage for weed control that causes undesirable ecological shifts in weed populations, soil erosion, and impairs water quality; and increases energy requirements and equipment needs;

c. Stabilize agricultural production by reducing inflationary pressures created by losses caused by pests, the cost of pest control, and failure of control practices;

d. Improved IPM information, education, and technical assistance, including grower decisions in choosing methods for controlling complexes of pests that impair crop and livestock production systems; and

e. Provide an adequate supply of reasonably priced high-quality nutritious food that is free from toxin and pesticide contamination.

CONCEPT OF IPM

The term "Integrated Pest Management" has been variously defined. There is a continuing differential interpretation of its meaning. This differential interpretation of IPM is continuing to cause difficulties in defining meaningful IPM programs and management systems for them.

Secretary's Memorandum No. 1929, "USDA Policy on Management of Pest Problems," defines IPM as a desirable approach to the selection, integration, and use of methods on the basis of their anticipated economic, ecological, and sociological consequences. In keeping with the Secretary's policy, the SEA IPM team proposes a concept for classifying IPM programs in SEA according to the following major elements:

1. Basic research.

2. Control components research.

3. IPM systems research, level I.

4. IPM systems research, level II.

5. Extension IPM systems, level I.

6. Extension IPM systems, level II.

7. IPM higher education.

The interrelationships among these elements are illustrated in Figure 1.

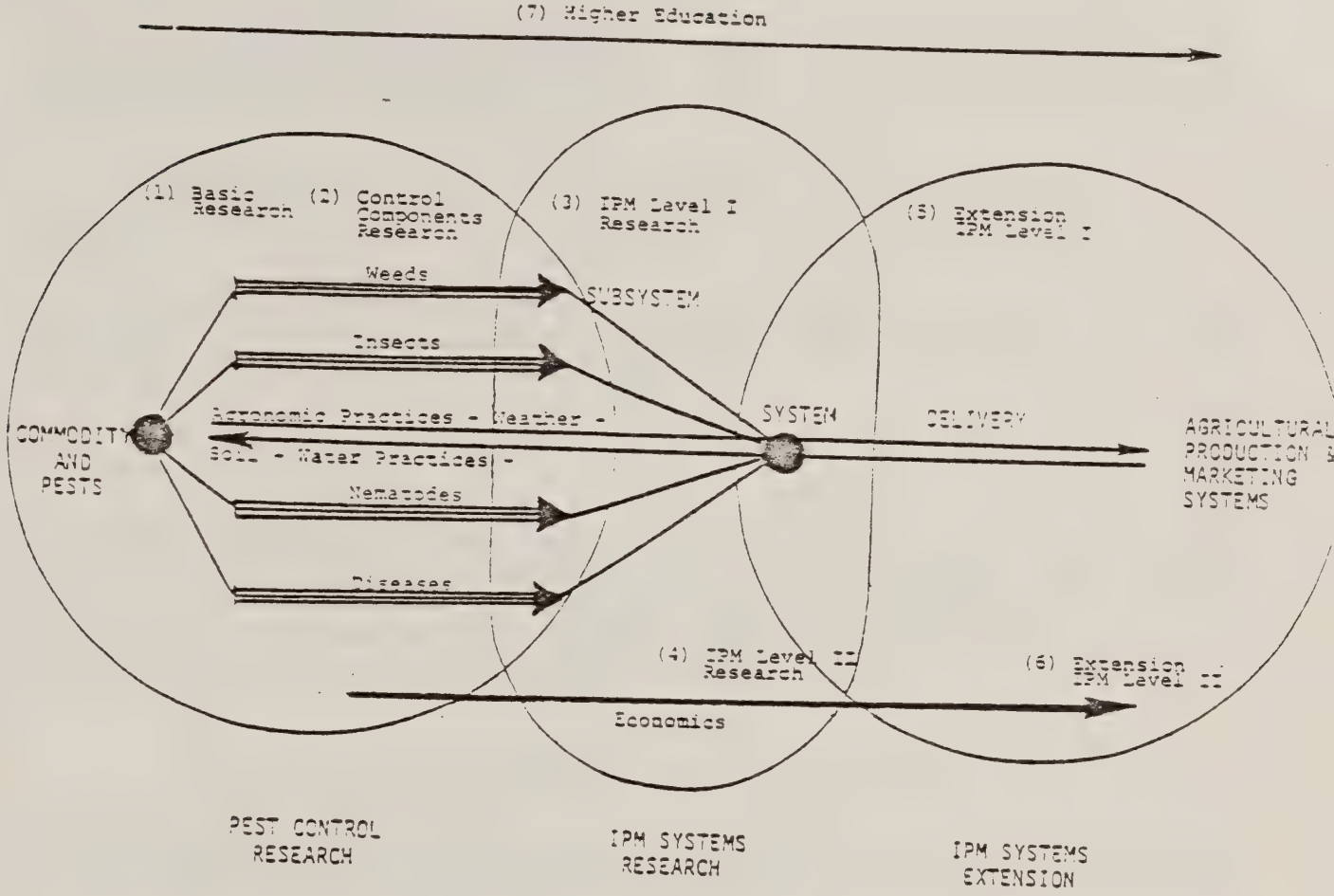

Figure 1. Interrelationships among basic research, control components research, IPM systems research Levels I and II, IPM systems extension Levels I and II, and higher education in IPM.

We propose to define the elements of the SEA program on pests and their control as follows:

1. Basic research - generates the knowledge required to understand pests and to develop control strategies for individual pests and pest complexes. Examples include research on life cycles, population dynamics, mode-of-action of pesticides, epidemiology, and ecology.

2. Control components research - develops specific control techniques and related technologies. Examples include research to develop pest-resistant crop varieties and livestock breeds; and biological, cultural, and chemical methods.

3. IPM systems research, level I - consists of research to integrate two or more control techniques to manage one or more species of the same grouping such as weeds (pigweed, crabgrass, ragweed). Such programs are referred to as integrated weed management systems; integrated insect management systems; integrated nematode management systems; and integrated disease management systems.

4. IPM systems research, level II - consists of research to integrate two or more management systems for two or more pest groupings, such as diseases and insects or diseases and weeds.

5. Extension, level I - delivers technology for managing pests of one grouping, such as insects, weeds, diseases, or nematodes on one or more commodities.

6. Extension, level II - delivers management systems for pests belonging to two or more groupings, such as diseases and insects, and diseases and weeds, on one or more commodities.

7. Higher education in IPM - Development and support of university-level education for IPM.

The SEA IPM Coordination Team has reviewed all CRIS Work Units and Extension projects and classified them according to the system outlined above. The data for FY 1977 on programs and resources have been computerized for storage, retrieval, and analysis and are presented in total in attachment 1. A summary is presented in Tables 1 and 2.

TECHNOLOGICAL OBJECTIVES OF SEA IPM PROGRAMS

The SEA IPM program is based on long-range objectives designed to develop and implement the necessary technology to manage pests. The Technological Objectives (TO's) of the program are:

IPM level I: Development and implementation of technology for managing several pests of the same group on one or more commodities. The TO's of this level involve the development of new and improved disease, insect, nematode, and weed management systems technology and educational programs for use in production units consisting primarily of the commodities used in the TO's listed below. This technology will increase efficiency in food, feed, and fiber production, reduce losses in yield and quality, reduce the cost of control, reduce energy requirements, and and improve environmental quality.

TO 1. Develop and implement IPM systems for field crops. Major emphasis will be on corn, sorghum, and millet; small grains such as wheat, oats, barley, rice and rye; cotton and other fiber crops; oilseed crops such as soybean, peanuts, flax, sunflower, and safflower; sugar crops such as sugarbeets, sugarcane, and sweet sorghum and various rotations and cropping sequences of field crops.

TO 2. Develop and implement IPM systems for use in horticultural crops. Major emphasis will be on the major vegetable crops; fruit, nut, and specialty crops; florist and nursery crops; turf; and various rotational and cropping sequences of these crops.

TO 3. Develop and implement IPM systems for use in forage crops, pastures, and rangelands.

TO 4. Develop and implement IPM systems for managing aquatic weed populations. Major emphasis will be on systems that will improve water quality, increase the efficiency of agricultural irrigation systems, and improve fish and wildlife habitats and recreational areas.

TO 5. Develop and implement systems for insect and poisonous weed management and educational programs for use in livestock production and protection of people.

TO 6. Develop and implement IPM systems for use in storage, transportation, and marketing systems.

TO 7. Develop and implement IPM systems for use in forestry.

IPM level II: Development and implementation of technology for managing two or more groups of pests in one or more commodities. The TO's of this level involve emphasis on the development and implementation of new and improved integrated management systems technology and educational programs for use in commodities. This emphasis will increase efficiency in food, feed, and fiber production, reduce losses in yield and quality. reduce the cost of control, reduce energy requirements, and improve environmental quality.

TO 8. Develop and implement IPM systems for field crops. Major emphasis will be on crop, livestock, and marketing systems, including the major grain crops such as corn, sorghum, and millet; small grain crops such as wheat, oats, barley, rice, and rye; cotton; oilseed crops; sugar crops; and cropping sequences; crop rotations; and livestock management systems.

TO 9. Develop and implement IPM systems for horticultural crops including programs for homeowners and gardeners. Major emphasis will be on crop and marketing production systems, including the major vegetable crops; fruit, nut and specialty crops; florist and nursery crops; and turf crops.

TO 10. Develop and implement IPM systems for forage crops, pastures, and rangeland. Major emphasis will be on crop, livestock, and marketing systems.

TO 11. Develop and implement IPM systems for managing aquatic resources. Major emphasis will be on developing technology for managing aquatic weeds, insects, and nematodes, to improve aquaculture productivity, water quality, fish and wildlife habitats, and recreational areas.

TO 12. Develop and implement IPM systems for insects and poisonous weeds for use in livestock production systems and protection of people.

TO 13. Develop and implement IPM systems for use in post-harvest storage, transportation, and marketing systems. Major emphasis will be on technology to improve environmental quality and reduce hazards to human health.

TO 14. Develop and implement IPM systems for use in forestry.

BASE AND EXPANDED IPM PROGRAMS IN SEA AND CU's

The FY 1979 and FY 1980 SEA and CU's IPM programs are comprised of base research programs before FY 1979 and programs expanded by FY 1979 and by proposed FY 1980 appropriations.

Base Program - Considerable IPM research is being conducted in base programs supported by AR, Hatch, State, other Federal and non-Federal sources. The estimated funding levels for basic research, control components research, IPM systems research levels I and II, and Extension IPM systems levels I and II in the 1977 base program in SEA and CU for diseases, insects, nematodes, and weeds, and other pests for seven commodity groupings are shown in Attachment 1. A summary of FY 1977 basic research, control components research, IPM systems research levels I and II, and Extension IPM systems levels I and II is presented by commodities (TO's) in Table 1 and by pest groups in Table 2.

Expanded Programs - The FY 1979 Agricultural Appropriations Act provided for expansion of IPM and related programs in AR, CR, and E. The FY 1979 IPM budget requests of the respective SEA units were developed before the establishment of SEA, at which time a formed program classification for IPM did not exist. Thus, all funds for research were allocated for priority problems not only involving systems research, but also for related basic and control components research. A similar situation existed in the development of the FY 1980 budget. FY 1979 and FY 1980 Extension programs were targeted for levels I and II with emphasis on level II. Funding levels by TO's (commodities) for AR, CR, E, and Higher Education (HE) are shown in Table 3.

A DESCRIPTION OF SEA UNIT IPM PROGRAMS

Agricultural Research

Base Program: The base research program on pests and their control for Agricultural Research is achieved through the implementation of five major target objectives.

Table 1. FY 1977 Level of Research in SEA and CU's on Pest and Their Control Including IPM Systems. Data are Summarized by Commodities.

Commodities	Basic Research AR Funds X$1000	Basic Research AR SY's	Basic Research STATE Funds X$1000	Basic Research STATE SY's	Control Components Research AR Funds X$1000	Control Components Research AR SY's	Control Components Research STATE Funds X$1000	Control Components Research STATE SY's	IPM Systems Research, Level I AR Funds X$1000	IPM Systems Research, Level I AR SY's	IPM Systems Research, Level I STATE Funds X$1000	IPM Systems Research, Level I STATE SY's	IPM Systems Research, Level II AR Funds X$1000	IPM Systems Research, Level II AR SY's	IPM Systems Research, Level II STATE Funds X$1000	IPM Systems Research, Level II STATE SY's	Subtotal AR Funds X$1000	Subtotal AR SY's	Subtotal STATE Funds X$1000	Subtotal STATE SY's	Total Funds X$1000	Total SY's
Field Crops	$ 7,464	82.9	$ 9,091	118.7	$14,746	164.2	$17,508	197.2	$1,067	11.5	$3,300	37.0	$ 73	1.1	$208	2.5	$23,350	259.6	$30,267	355.3	$53,617	614.9
Horticultural Crops	3,899	42.8	7,970	105.3	7,581	79.0	16,490	212.0	596	6.0	3,054	40.0	53	.5	337	3.5	12,131	128.2	27,851	360.8	39,982	489.0
Range & Pasture	1,307	15.5	1,692	23.3	2,694	34.1	3,308	44.7	328	3.7	555	7.7		.0	22	.3	4,328	53.4	5,577	76.0	9,905	129.4
Water	1,049	11.2	811	11.7	608	6.1	354	3.5	61	.6	16	.3		.0		.0	1,718	17.8	1,181	15.4	2,899	33.2
Livestock	2,844	29.9	1,325	17.6	2,355	20.8	967	11.8			10	.1		.0		.0	5,199	50.7	2,302	29.4	7,501	80.1
Post Harvest	1,560	20.3	457	5.0	2,876	37.0	767	8.8	22	.3	155	1.9		.0		.0	4,458	57.6	1,379	15.8	5,837	73.4
Forestry	369	3.2	3,639	44.9	753	6.2	5,221	64.1		.0	507	6.6		.0	76	1.0	1,122	9.4	9,443	116.7	10,565	126.1
Other 1/	17,333	208.9	18,169	230.4	11,252	120.5	12,551	156.7	465	3.9	1,539	22.0		.0	56	.9	29,050	333.3	32,315	410.0	61,365	743.7
TOTAL	$35,825	414.7	$43,159	556.9	$42,867	467.8	$57,246	698.7	$2,539	26.0	$9,216	115.6	$126	1.5	$699	8.2	$81,356	910.0	$110,315	1,379.4	$191,671	2,289.4

1/ Includes research related to pollution; birds; rodents; fungi and spoilage organisms; toxins and poisonous plants; and biology of pest species.

Table 2. FY 1977 Level of Research in SEA and CU's on Pest and Their Control Including IPM Systems. Data are Summarized by Pest Groups.

Pest Group	Basic Research AR Funds X$1000	Basic Research AR SY's	Basic Research STATE Funds X$1000	Basic Research STATE SY's	Control Components Research AR Funds X$1000	Control Components Research AR SY's	Control Components Research STATE Funds X$1000	Control Components Research STATE SY's	IPM Systems Research, Level I AR Funds X$1000	IPM Systems Research, Level I AR SY's	IPM Systems Research, Level I STATE Funds X$1000	IPM Systems Research, Level I STATE SY's	IPM Systems Research, Level II AR Funds X$1000	IPM Systems Research, Level II AR SY's	IPM Systems Research, Level II STATE Funds X$1000	IPM Systems Research, Level II STATE SY's	Subtotal AR Funds X$1000	Subtotal AR SY's	Subtotal STATE Funds X$1000	Subtotal STATE SY's	Total Funds X$1000	Total SY's
Insects 1/	$11,446	118.7	$10,525	131.7	$23,057	237.3	$25,828	306.1	$1,019	8.6	$2,323	26.1	$ 8	0.1	$141	1.6	$35,530	364.7	$38,817	465.5	$74,347	830.2
Plant Pathogens	5,330	66.1	12,927	177.8	9,716	113.5	18,179	237.4	541	6.5	1,873	53.2	117	1.4	470	5.4	15,706	187.5	35,449	473.8	51,444	661.3
Nematodes	401	6.2	1,072	16.0	675	8.1	1,381	19.4	180	2.2	500	7.1	--	--	13	0.2	1,338	16.5	2,966	42.7	4,304	59.2
Weeds	1,979	21.6	2,788	36.2	2,704	31.1	6,406	72.4	663	7.2	2,155	24.0	--	--	19	0.2	5,426	60.0	11,368	132.8	16,794	192.0
Total	$19,238	212.6	$27,312	361.7	$36,232	390.0	$51,794	635.3	$2,405	24.5	$8,851	110.4	$125	1.5	$643	7.4	$58,000	628.7	$88,600	1,114.8	$146,600	1,743.5
Other 2/	16,586	202.1	15,841	195.2	6,635	77.8	5,451	63.5	133	1.4	365	5.3	0.0	0.0	56	0.8	23,354	281.3	21,713	264.8	45,067	546.1
TOTAL	$35,824	414.7	$43,153	556.9	$42,867	467.8	$57,245	698.8	$2,538	25.9	$9,216	115.7	$125	1.5	$696	8.2	$81,355	910.0	$110,313	1,379.6	$191,667	2,289.6

1/ Includes research on insects affecting livestock and people.

2/ Includes research related to pollution; birds; rodents; fungi and spoilage organisms; toxins and poisonous plants; and biology of pest species.

ir Control Including IIM

ol Components Research				IIM Systems Research, Level I				IIM Systems Research, Level II				Subtotal				Total	
AR		STATE		AR		STATE		AR		STATE		AR		STATE			
's	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's
00																	
746	164.2	$17,588	197.2	$1,067	11.5	$3,380	37.0	$ 73	1.1	$208	2.5	$23,350	259.6	$30,267	355.3	$53,617	614.9
081	29.0	16,490	212.0	596	6.0	3,054	40.0	53	.5	337	3.5	12,131	128.2	27,851	360.8	39,982	489.0
094	34.1	3,308	44.7	328	3.7	555	7.7		.0	22	.3	4,328	53.4	5,577	76.0	9,905	129.4
008	6.1	354	3.5	61	.6	16	.3		.0		.0	1,718	17.8	1,181	15.4	2,899	33.2
55	20.8	967	11.8			10	.1		.0		.0	5,199	50.7	2,302	29.4	7,501	80.1
76	37.0	767	8.8	22	.3	155	1.9		.0		.0	4,458	57.6	1,379	15.8	5,837	73.4
53	6.2	5,221	64.1		.0	507	6.6		.0	76	1.0	1,122	9.4	9,443	116.7	10,565	126.1
52	120.5	12,551	156.7	465	3.9	1,539	22.0		.0	56	.9	29,050	333.3	32,315	410.0	61,365	743.7
67	467.8	$57,246	690.7	$2,539	26.0	$9,216	115.6	$126	1.5	$699	8.2	$81,356	910.0	$110,315	1,379.4	$191,671	2,289.4

and spoilage organisms;

r Control Including IIM

ol Components Research				IIM Systems Research, Level I				IIM Systems Research, Level II				Subtotal				Total	
AR		STATE		AR		STATE		AR		STATE		AR		STATE			
s	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's	Funds X$1000	SY's
0																	
57	237.3	$25,828	306.1	$1,019	8.6	$2,323	26.1	$ 8	0.1	$141	1.6	$35,530	364.7	$38,817	465.5	$74,347	830.2
16	113.5	18,179	237.4	541	6.5	1,873	53.2	117	1.4	470	5.4	15,706	187.5	35,449	473.8	51,444	661.3
75	8.1	1,381	19.4	180	2.2	500	7.1	--	--	13	0.2	1,338	16.5	2,966	42.7	4,304	59.2
34	31.1	6,406	72.4	663	7.2	2,155	24.0	--	--	19	0.2	5,426	60.0	11,368	132.8	16,794	192.8
32	190.0	$51,794	635.3	$2,405	24.5	$8,851	110.4	$125	1.5	$643	7.4	$58,000	628.7	$88,600	1,114.8	$146,600	1,743.5
35	77.8	5,451	63.5	133	1.4	365	5.3	0.0	0.0	56	0.8	23,354	281.3	21,713	264.8	45,067	546.1
57	467.8	$57,245	698.8	$2,538	25.9	$9,216	115.7	$125	1.5	$696	8.2	$81,355	910.0	$110,313	1,379.6	$191,667	2,289.6

and spoilage organisms;

Table 3. SEA Implementation Plans by TO's (Commodities) for FY 1979 and FY 1980 Expanded Program

IPM Level I	FY 1979								FY 1980						
	AR		CR 1/		E		HE 2/		AR		CR 1/		E		HE
	Funds	MY	Funds	MY	Funds	MY	Funds	MY	Funds	MY	Funds	MY	Funds	MY	Funds
TO 1, Field Crops	347,700				3,347,000	111.6			559,000				3,577,000	119.2	
TO 2, Horticultural Crops	150,600				999,000	33.3			164,000				1,309,000	43.6	
TO 3, Range & Pasture	10,000				426,000	14.2			66,000				551,000	18.4	
TO 4, Water	10,000				0.0	0.0			94,000				0 0	0.0	
TO 5, Livestock	160,000				90,000	3.0			518,000				125,000	4.2	
TO 6, Post Harvest	5,300				0.0	0.0			44,000				0.0	0.0	
TO 7, Forestry															
Subtotal	683,600				4,862,000	162.1			1,445,000				5,562,000	185.4	
IPM Level II															
TO 8, Field Crops	41,500				217,000	7.2			162,000				332,000	11.1	
TO 9, Horticultural Crops	20,000				334,000	11.1			86,000				509,000	17.0	
TO 10, Range & Pasture					22,000	0.0			66,000				32,000	1.1	
TO 11, Water					0.0	0.0			44,000				0.0	0.0	
TO 12, Livestock					0.0	0.0			88,000				0.0	0.0	
TO 13, Post Harvest					0.0	0.0			44,000				0.0	0.0	
TO 14, Forestry															
Subtotal	61,500				573,000	18.3			400,000				873,000	29.2	
TOTAL	744,500		500,000		5,435,000	180.4	0.0		1,935,000		500,000		6,435,000	214.6	0.0

1/ Special Grants Program of $500,000 appropriated for FY 1979 to be awarded by May 1979. The FY 1980 budget includes a continuation of the Special Grants Program at the same funding level.

2/ No funds appropriated for FY 1979 and FY 1980.

FY 1979 INCREASE FOR IPM RESEARCH IN AR

Objective	Location	NRP	Total Amount	Basic Research	Control Components Research	IPMS Level I Research	IPMS Level II Research
Develop weed management systems for small grains that do not impair environmental quality.	Urbana, IL	20280	$100,000	$30,000	$ 40,000	TO 1 $30,000	
Develop basic understanding of weed crop interaction, identify periods in life cycle when weeds are most vulnerable to control and develop weed management systems for small grains without environmental impairment.	Fargo, ND and Columbia, MO	20280	300,000	90,000	120,000	TO 1 90,000	
Determine the chemical basis of alleopathic effects of such species as rye on wild oats, cucumber on millet and mustard, spikerush on aquatic weeds. Develop basic information needed to include alleopathic effects in pest management systems.	Stoneville and State College, MS	20280 20170	100,000	50,000	20,000	TO 1 10,000 TO 2 10,000 TO 4 10,000	
Determine beneficial aspects of integration of practices to develop IPM systems for weeds, insects, nematodes, and plant pathogens involving three levels of pest management intensity, three levels of cultivation, and four cropping sequences.	Tifton, GA	20270	$100,000	10,000	20,000	TO 1 12,000 TO 2 8,000	TO 1 30,000 TO 2 20,000
Control plant pathogens under varying tillage and soil conditions.	Pullman, WA	20270 20260	100,000	30,000	40,000	TO 1 30,000	
Determine effects of soil factors on incidents and characteristics of epizootics involving insect pathogens.	Fresno, CA	20260	100,000	40,000	40,000	TO 2 20,000	
Identify and characterize the major physical, chemical, and microbiological factors of soils that tend to suppress root feeding insects. Develop tillage practices and use of soil amendments for suppressing major root feeding pests.	Morris, MN and Brookings, SD	20750	140,000	56,000	42,000	TO 1 42,000	
Develop technology for preventing damage to crops caused by nematodes.	Weslaco, TX	20270	110,000	44,000	33,000	TO 1 33,000	
Develop IPM systems for stable fly control.	Lincoln, NE	20480	250,000	25,000	75,000	TO 5 150,000	
Develop basic information on the structure-activity of insect hormones needed to devise a new class of safe, efficient, and environmentally compatible systemic insecticides for controlling insects of livestock.	College Station, TX	20480	100,000	60,000	30,000	TO 5 10,000	
Develop IPM systems for controlling insects of sweetpotato.	Baton Rouge, LA	20220	100,000	20,000	60,000	TO 2 20,000	
TOTAL			$1,500,000	$455,000	$520,000	$475,000	$50,000

In addition to the $1,500,000 requested in the President's budget and appropriated by the Congress for IPM research, the Congress also appropriated $1,918,000 for basic research, control components research, and systems research on pests and their control Emphasis will be on the development of multiple-pest-resistant crops and biological, cultural, and chemical methods. These funds were allocated as follows:

FY 1979 CONGRESSIONAL ADD-ON FOR IPM RELATED RESEARCH IN AR

Objective	Location	NRP	Total Amount	Basic Research	Control Components Research	IPMS Level I Research	IPMS Level II Research
Analytical methods for insect pheromones	Gainesville, FL	20250	$ 70,000	$28,000	$ 28,000	TO 1 $ 7,000 TO 2 7,000	
Improve mass rearing technology for fall armyworm	Tifton, GA	20300	100,000	40,000	60,000		
Develop male sterile release tech- for pink bollworm	St. Croix, VI	20230	100,000	10,000	40,000	TO 1 50,000	
Develop techniques for storage and distribution of insect parasites of cotton bollworms	College Station, TX	20260	90,000	9,000	45,000	TO 1 18,000 TO 2 18,000	
Develop a basic understanding of the genetics of mosquitoes as a means of determining their vulnerability to control	Gainesville, FL	20850	53,000	26,500	21,200	TO 6 5,300	
Develop a biological control quarantine capability for the introduction of organisms for pest control	Stoneville, MS	20260	100,000	30,000	70,000		
Develop the use of plant pathogens for controlling weeds in crops and rangelands	Albany, CA	20260	100,000	30,000	60,000	TO 1 10,000 TO 3 10,000	
Develop a basic understanding of the behavior and nutritional requirements of rearing parasites for control of cotton insects	Tucson, AZ	20260	150,000	$ 45,000	105,000		
Develop technology for controlling diseases of lettuce	Salinas, CA	20270	70,000	21,000	35,000	TO 2 14,000	
Develop a basic understanding of the genetics of disease resistance in tomatoes and potatoes	Prosser, WA	20020	50,000	20,000	20,000	TO 2 10,000	
Develop genetic stocks and breeding lines of corn that are resistant to corn rootworm and other soilborne insects	Brookings, SD	20040	$100,000	30,000	$ 50,000	TO 1 $10,000	TO 7 $10,000
Develop fundamental technology on the nutritional requirements for rearing corn rootworm	Brookings, SD Fargo, ND	20240 20250	200,000	100,000	100,000		
Develop fundamental knowledge of the basis for the resistance of small grains to diseases	Urbana, IL	20270	15,000	4,500	7,500	TO 1 1,500	TO 7 1,500
Develop improved technology for controlling diseases of small grains	Gainesville, FL	20050	14,000	1,400	8,400	TO 1 4,200	
Develop improved technology for Japanese beetle control on ornamentals	Wooster, OH	20220	60,000	12,000	30,000	TO 2 18,000	
Develop IPM systems for insects of horticultural crops	Lafayette and Vincennes, IN	20220	73,000	14,600	36,500	TO 2 21,900	
Develop quarantine capabilities for introducing plant pathogens for control of weeds	Frederick, MD	20260	90,000	45,000	45,000		
Develop improved technology for the use of antifeedants as a system for controlling insects of plants	Beltsville, MD	20250	37,000	14,800	18,500	TO 2 3,700	
Develop a basic understanding of the alleopathic effects of weeds as a means for their control in crops	Beltsville, MD	20290	171,000	102,600	68,400		
Develop an improved taxonomic capability for identifying insects, plant pathogens, nematodes, and weeds	Beltsville, MD	20260 20270	270,000	189,000	81,000		
Develop a basic understanding of the effects of the wax moth on bee culture, crop pollination, and honey production	Baton Rouge, LA	20180	5,000	1,000	4,000		
TOTAL			$1,918,000	$774,400	$923,500	$208,500	$ 11,500

The FY 1980 budget proposes to eliminate all of the above projects.

FY 1980 Expanded IPM Research Program: AR plans to implement the FY 1980 expanded program by conducting intramural and supporting extramural IPM research. Emphasis will be on the development of multiple-pest-resistant crops and livestock and biological, cultural, and chemical methods. The President's budget requested funds for nine major new projects. These are outlined below:

PROPOSED BY 1980 BUDGET INCREASE FOR IPM RESEARCH IN AR

Objective	Location	NRP	Total Amount	Basic Research	Control Components Research	IPMS Level I Research	IPMS Level II Research
Develop an SRP entitled, "Integrated Pest Management Systems." The objectives of this research will be to determine the efficacy and economics of IPM systems for controlling one or more pest suppression techniques for pests that are not effectively controlled by current technology.	Nationwide	Special SRP	$1,100,000	$110,000	$110,000	TO 1 $132,000 TO 2 66,000 TO 3 66,000 TO 4 44,000 TO 5 88,000 TO 6 44,000	TO 8 $132,000 TO 9 66,000 TO 10 66,000 TO 11 44,000 TO 12 88,000 TO 13 44,000
Develop an IPM system for controlling the fall armyworm in Florida to prevent its migration up the East Coast of the United States	Tifton, GA and Gainesville, FL	20240 20250	300,000	90,000	150,000	TO 1 60,000	
Develop IPM systems for weed control in grain crops	Fargo, ND	20280	200,000	40,000	80,000	TO 1 80,000	
Develop IPM systems for aquatic weed management	Ft. Lauderdale FL	20280	100,000	20,000	40,000	TO 4 40,000	
Develop practical methods for biological control of soilborne diseases to use in IPM systems	Beltsville MD	20270	200,000	40,000	80,000	TO 1 40,000 TO 2 40,000	
Develop IPM systems for bluetongue control of livestock	Denver, CO	20480	100,000	20,000	40,000	TO 5 40,000	
Develop IPM systems for salt marsh mosquitoe suppression with emphasis on biological control	Lake Charles, LA	20480	100,000	20,000	60,000	TO 5 20,000	
Develop IPM systems for mosquito and dogfly utilizing biological, genetic attractants, repellents, and insecticidal methods. Computer models of pest populations will be developed.	Gainesville, FL	20850	350,000	35,000	105,000	TO 5 210,000	
Develop improved mosquito repellents	Beltsville MD	20250	50,000	25,000	25,000		
TOTAL			$2,300,000	$400,000	$690,000	$970,000	$440,000

Cooperative Research

Base Program: Cooperative Research through distribution of Hatch formula funds (approximately 18 percent of all expendable funds available for research at the state level) supports state and regional research for (a) basic, component, and systems science research for management of pests in production agroecosystems and (b) research to adapt generalized IPM systems to local, state, and regional needs. The research program is achieved through the implementation of five major target objectives.

Target Objective	Planned SY's	FY 1978 $Millions
1. Fundamental biology	0	5.8
2. Improved means of pesticide control	0	4.8
3. Improved pesticide use patterns	0	3.7
4. Toxicology, pathology, metabolism and fate	0	1.9
5. Economics of pest control	0	0.4
TOTAL	0	16.6

The above data represent CR allocations only and do not include state contributions; consequently, no SY's are given (see text table, page 6) for data on Federal and non-Federal-administered funds to SAES).

Basic and component pest control research will be conducted at all SAES and Tuskegee and 1890 institutions. IPM level I research will be conducted by SAES and 1890 institutions at more than 50 major locations. IPM level II research will be conducted at about 15 SAES's including New York, North Carolina, Florida, Georgia, Texas, California, Washington, Michigan, Indiana, and Nebraska.

The planning and establishment of research priorities for the base programs on pests and their control are achieved at the state, regional, and national and Federal levels. At the state level, research priorities are established by the Directors of the individual SAES. At the regional level, priorities are identified and funded through the four national regions by the respective Regional Associations of State Agricultural Experiment Station Directors (see Attachment 3) for examples of the cooperative efforts in regional research projects in pest control among the states).

At the national level, input is through ESCOP which is officially involved in early policy planning stages through establishment of administrative procedures and planning processes. This planning is accomplished through committee structures. At the Federal level, a CR/IPM committee composed of CR specialists and consulting scientists from the SAES, representing the various pest disciplines, helps in the planning and coordination of new priority areas as identified by the regional and national organizations. This committee also has the responsibility for developing the guidelines for the IPM Special Grants Program (PL 89-106).

FY 1979 Program - In FY 1979, CR received no new funds for basic, control components, or IPM research. A continuing allocation (since 1976) of $500,000 as Special Grants under PL 89-106, is currently available for IPM research. These funds will be awarded as competitive grants and will be funded by May 1979. The specific area of inquiry deals with "research on integrated methods of suppression involving complexes of two or more

pest groups (insects, plant pathogens, nematodes, weeds) affecting one or more closely related crops." Since this area of inquiry is the same as in the previous year, the allocation of FY 1978 funds is listed below as examples of the types of research that will be supported in FY 1979 by the Special Grants Program. Although the guidelines imply level II research, implementation of the projects includes basic, control components, and level I research.

Title	Location	Total Amount	Basic Research	Control Components Research	IPMS Level I Research		IPMS Level II Research	
Integrated Pest Management of Celery--A High Value, Intensively Cultured Vegetable Crop	IFAS, University of Florida (AES)	$ 82,000	$ 32,800	$ 32,800	TO 2	$ 8,200	TO 9	$ 8,200
Interaction Effects of Pesticides on Crop Plants, Pests, and Beneficial Organisms in a soybean-corn production system	North Carolina State University (AES)	90,500	36,200	36,200	TO 1	9,050	TO 3	9,050
Development and Implementation of an Integrated Pest Management System for Peanuts Utilizing Agro-environmental Data	Virginia Polytechnic Institute and State University (AES)	70,000	14,000	28,000	TO 1	14 000	TO 3	14 000
Implementation of Management Strategies for corn pests based on prediction of yield losses resulting from Interaction of Corn Rootworms Lesion Nematodes and the Anthracnose Fungus	Purdue University (AES)	84,000	33,600	33,600	TO 1	8,400	TO 3	8,400
Integrated Pest Management in Disease-Resistant Dwarf Apples	New York Agricultural Experiment Station (Geneva)	83,500	16,700	16,700	TO 2	25,050	TO 9	25,050
Integrated Pest Management of Onion Maggot and Northern Root-Knot Nematode	Michigan State University (AES)	90,000	18,000	36,000	TO 2	18,000	TO 9	18,000
TOTAL		$500,000	$151,300	$183,300		$82,700		$82,700

FY 1980 Expanded IPM Research Program: CR plans to implement the FY 1980 program by supporting level I and II research. The President's budget requested funds for (a) continuation of the Special Grants Program under PL 89-106 ($500,000), and (b) initiation of new programs allocated through Hatch formula to SAES ($3,000,000). Seventy-two percent of the funds will be used to provide local data for the development of general commodity and production agroecosystems models, adapt models to state and local conditions, and contribute to the refinement of generalized models. The remaining funds (28 percent) will be used for regional research to develop regional pilot research projects for generalized IPM systems for multicommodities.

As the generalized IPM system needs dictate, contributing states will provide basic, control components, and system science data.

Extension - In 1979, all states will have Extension IPM programs that will eventually become the basis for developing statewide educational efforts. Eleven southern states are developing statewide extension programs for managing bollweevil and other major cotton pests. In the second year (1979), the Optimum Pest Management Trial in Panola County, Mississippi, will involve 36,000 acres, and 98 percent of the growers will follow a complete IPM schedule that was devised by research and extension workers. The total national extension program encompasses 28 commodities and has earned increased support by growers, private consultants, and producer

organizations. Training, technical assistance, and information materials are being provided for crop and animal producers, home owners, scouts, private consultants, farmers' IPM organizations, and industry.

These programs are designed to 1) develop and implement an effective, integrated program to prevent or mitigate losses caused by pests through use of biological, cultural, chemical, and varietal methods of control; 2) implement practical methods for monitoring pest populations in farmers' fields; and 3) provide farmers and others in the private sector with information and training in the principles of IPM.

FY 1979 increases of $1 million are being used to expand pest management programs by 1) increasing the numbers of pests and commodities covered; 2) providing greater participation of all crop protection disciplines; and 3) extending the program into additional counties in each state.

These funds have been allocated as follows:

IPM EXTENSION PROGRAMS
FY 1979

State	Total	Commodities	Level I	Level II
Alabama	221,160	Field Crops	146,160	35,000
		Horticultural Crops	30,000	10,000
Alaska	27,000	Horticultural Crops	27,000	0
Arizona	55,000	Field Crops	45,000	10,000
Arkansas	210,390	Field Crops	175,390	25,000
		Range & Pasture	10,000	0
California	148,000	Field Crops	25,000	5,000
		Horticultural Crops	75,000	20,000
		Range & Pasture	33,000	0
Colorado	55,000		0	55,000
Connecticut	34,000	Horticultural Crops	30,000	4,000
Delaware	34,000	Field Crops	5,000	0
		Horticultural Crops	25,000	4,000
District of Columbia	0		0	0
Florida	96,000	Field Crops	0	25,000
		Horticultural Crops	0	71,000
Georgia	304,955	Field Crops	124,955	80,000
		Horticultural Crops		50,000
Guam	7,000	Horticultural Crops	7,000	0
Hawaii	34,000	Horticultural Crops	0	34,000

State	Total	Commodities	Level I	Level II
Idaho	55,000	Field Crops	25,000	0
		Horticultural Crops	0	25,000
		Range & Pasture	5,000	0
Illinois	158,000	Field Crops	113,000	20,000
		Range & Pasture	20,000	5,000
Indiana	117,000	Field Crops	77,000	15,000
		Range & Pasture	23,000	2,000
Iowa	158,000	Field Crops	158,000	0
Kansas	96,000	Field Crops	63,900	7,100
		Range & Pasture	20,000	5,000
Kentucky	55,000	Field Crops	20,000	10,000
		Range & Pasture	12,500	12,500
Louisiana	234,340	Field Crops	189,340	45,000
Maine	55,000	Horticultural Crops	0	55,000
Maryland	55,000	Field Crops	10,000	0
		Horticultural Crops	40,000	5,000
Massachusetts	55,000	Horticultural Crops	0	55,000
Michigan	96,000	Field Crops	0	5,000
		Horticultural Crops	0	91,000
Minnesota	137,000	Field Crops	100,000	12,000
		Horticultural Crops	0	25,000
Mississippi	276,730	Field Crops	200,730	76,000
Missouri	158,385	Field Crops	110,000	23,385
		Range & Pasture	25,000	0
Montana	55,000	Range & Pasture	55,000	0
Nebraska	137,000	Field Crops	30,000	7,000
		Range & Pasture	20,000	5,000
		Livestock	75,000	0
Nevada	27,000	Range & Pasture	27,000	0
New Hampshire	38,000	Horticultural Crops	4,000	30,000
New Jersey	55,000		5,000	50,000
New Mexico	34,000	Range & Pasture	34,000	0
New York	55,000		20,000	55,000
North Carolina	166,910	Field Crops	49,910	117,000
North Dakota	55,000	Field Crops	0	55,000
Ohio	137,000	Field Crops	50,000	37,000
		Range & Pasture	45,000	5,000

State	Total	Commodities	Level I	Level II
Oklahoma	191,250	Field Crops	116,250	55,000
		Horticultural Crops	20,000	0
Oregon	75,000	Horticultural Crops	10,000	0
		Range & Pasture	0	65,000
Pennsylvania	75,000	Horticultural Crops	0	50,000
		Range & Pasture	25,000	0
Puerto Rico	21,000	Horticultural Crops	0	21,000
Rhode Island	27,000	Horticultural Crops	0	27,000
South Carolina	169,085	Field Crops	94,085	0
		Horticultural Crops	0	75,000
South Dakota	55,000	Field Crops	0	55,000
Tennessee	149,090	Field Crops	74,090	0
		Horticultural Crops	50,000	25,000
Texas	572,705	Field Crops	522,705	0
		Horticultural Crops	50,000	0
Utah	27,000	Horticultural Crops	7,000	27,000
Vermont	27,000	Horticultural Crops	0	27,000
Virgin Islands	7,000	Horticultural Crops	0	7,000
Virginia	75,000	Field Crops	70,000	5,000
Washington	75,000	Field Crops	50,000	0
		Range & Pasture	25,000	0
West Virginia	27,000	Horticultural Crops	17,000	5,000
		Range & Pasture	5,000	0
Wisconsin	96,000	Field Crops	40,000	10,000
		Horticultural Crops	40,000	6,000
Wyoming	34,000	Field Crops	0	34,000
TOTAL	5,379,050		3,602,065	1,776,985
Reserve Funds	56,000			

The FY 1980 Extension budget includes an increase of $1 million to accelerate the adoption of IPM practices in all states. There will be no earmarked increase for the Cotton Insect Management program in 11 southern states. Through the use of IPM, losses due to insects and plant diseases can be cut and nonjudicious use of insecticides and fungicides can be reduced in situations where poorly timed applications are made.

In some cases, nonchemical methods of pest control can be used to reduce the nonjudicious use of pesticides. Extension's goal is a step-wise expansion of the program so that after 10 years IPM can be implemented on about two-thirds of the cultivated crops and livestock. The increase is essential to provide IPM education for additional farmers, scouts, scout supervisors, and county extension personnel, and to develop needed informational and training materials. The increase will be used to expand ongoing programs with commercial and small farmers and gardeners.

Funds will be allocated to the states on the same basis as in FY 1978 to expand ongoing IPM programs by increasing interdisciplinary coverage for pests that limit the production of crops and livestock, and getting more producers to become involved in IPM programs offered by private consultants and grower-operated organizations that provide for monitoring of pest populations, assessment and prediction of damage from pests, and decisions on choices of appropriate pest control methods.

The national Extension office will work with the states to coordinate extension activities with research and higher education programs in the Department and with related EPA programs. The need for this coordination was emphasized in a 1978 audit report on IPM programs.

Higher Education - As the concept of IPM has grown, there has been an increasing concern of an acute need for personnel with adequate formal education to deliver the systems concept at the operational level. With limited educational programs through which people can obtain a baccalaureate and higher level of education specific to integrated pest management, the delivery of IPM will be heavily dependent upon the partially informed practicing agriculturist.

The Office for Higher Education in SEA has served as a focal point for surfacing concerns relating to the needs of professional personnel for IPM. The academic community has continued to express the need for support at the national, state, and local levels for formal education programs at the baccalaureate, masters, and Ph.D. levels in this area. In the absence of a budget in FY 1979 with which to influence the development of educational programs, the Higher Education office at the national level has continued to evaluate the needs and plans for additional support.

ESCS PEST MANAGEMENT PROJECT -- KEY COMPONENTS

- ASSESS THE ECONOMIC IMPLICATIONS OF TECHNICALLY FEASIBLE BIOLOGICAL, CULTURAL AND INTEGRATED PEST MANAGEMENT METHODS AND PROGRAMS.

- EVALUATE THE ECONOMIC EFFECTIVENESS OF SELECTED LARGE AREA PEST CONTROL AND/OR ERADICATION AND QUARANTINE PROGRAMS (E.G., BOLL WEEVIL ERADICATION).

- ADAPT OR DEVELOP MODELS AND SYSTEMS TO ESTIMATE THE IMPACTS OF NEW TECHNOLOGIES AND EVALUATE INCENTIVES, DELIVERY SYSTEMS AND INSTITUTIONS TO PROMOTE ADOPTION OF NEW METHODS.

- DETERMINE AND ASSESS THE ECONOMIC AND SOCIAL ASPECTS OF ACTUAL OR PERCEIVED ENVIRONMENTAL HEALTH BENEFITS OF ADOPTION OF BIOLOGICAL AND CULTURAL CONTROLS.

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POTENTIAL CRITERIA FOR SELECT PROJECTS AND PROGRAMS FOR ECONOMIC EVALUATION

- Importance of the commodity, structure, etc., including value of production, importance to farm income, cost or extent of pest control, and contributions to the U.S. balance of payments.
- Environmental sensitivity to conventional and alternative controls, especially risk to human health and beneficial species.
- Human health hazard associated with target pest control program.
- Probability of a successful economic evaluation:
  - Experimental design that is adequate for provision of data for economic analysis (where applicable)
  - Availability of data for economic analysis
- Stage of technical feasibility
- Geographical distribution of the research activities
- Involvement of several disciplines in overall economic research activities.
- Desire to evaluate projects at different phases, i.e., technically feasible, in adoption stage, etc.
- Desire of biological staffs at project location to cooperate in an economic evaluation.
- Degree of present cooperation among USDA agencies and State institutions or agencies.

[illegible] OF THE COMMODITY [illegible], ETC., [illegible] VALUE OF PRODUCTION, [illegible] TARGET [illegible] [illegible] CONTRIBUTIONS TO THE U.S. [illegible]

[illegible] COMPATIBILITY - COMMERCIAL AND ALTERNATIVE CONTROLS, ESPECIALLY WITH [illegible] AND BENEFICIAL SPECIES

HUMAN HEALTH [illegible] ARGE [illegible] COST [illegible]

ADAPTABILITY [illegible] A [illegible] ECONOMIC EVALUATION

- [illegible] THAT IS ADEQUATE FOR PROVISION OF DATA FOR ECONOMIC ANALYSIS (WHERE APPLICABLE)

- AVAILABILITY OF DATA FOR ECONOMIC ANALYSIS

STAGE OF TECHNICAL FEASIBILITY

GEOGRAPHICAL DISTRIBUTION OF THE RESEARCH ACTIVITIES

INVOLVEMENT OF SEVERAL DISCIPLINES IN OVERALL ECONOMIC RESEARCH ACTIVITIES.

DESIRE TO EVALUATE PROJECTS AT DIFFERENT PHASES, I.E., TECHNICALLY FEASIBLE, IN ADOPTION STAGE, ETC.

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PRELIMINARY LIST OF PROJECTS AND PROGRAMS SUGGESTED FOR POSSIBLE ECONOMIC EVALUATION

I. Suggestions Received from SEA/AR National Program Staff Members:

Golden Nematode on Potatoes

Disease Resistance in Edible Legumes

Cyst Nematode on Soybeans

Disease Resistance in Cereals

Alternative Methods for Stored Product Insect Control in Peanuts

Pilot Testing of Weed Control Methods for Increased Livestock Production on Sagebrush-grass Rangelands of the West

Crop Rotations for Managing Nematodes, Diseases, Weeds and Insects

Total Weed Population Management for Irrigated Agriculture

Face Fly Suppression

Augmentation of *Trichogramma* Wasps for the Management of *Heliothis* Species on Field Crops and Vegetables

PRELIMINARY LIST OF PROJECTS AND PROGRAMS SUGGESTED FOR POSSIBLE ECONOMIC EVALUATION - CONTINUED

HELIOTHIS AND INSECT RESISTANT COTTON FOR HUMID AREAS

INTEGRATED MANAGEMENT OF THE PINK BOLLWORM

BIOLOGICAL CONTROL OF MOSQUITOS

STABLE FLY IPM IN FEEDLOT CATTLE

ECONOMICS OF HORNFLY CONTROL IN BEEF CATTLE

II. SUGGESTIONS RECEIVED FROM SEA/CR:

RELEASED PARASITES FOR CONTROL OF SELECTED WEEDS OF RANGE AND PASTURE

ALFALFA WEEVIL PARASITES AND ALFALFA MANAGEMENT SYSTEMS

LYGUS BUG CONTROL WITH REDUCED GROWING PERIOD BY IRRIGATION CUT-OFF

MANAGEMENT OF ARTHROPODS AND ASSOCIATED ECONOMIC LOSSES IN LIVESTOCK PRODUCTION

PRELIMINARY LIST OF PROJECTS AND PROGRAMS SUGGESTED FOR POSSIBLE ECONOMIC EVALUATION - CONTINUED

III. Suggestions Received from SEA/Extension:

Release Methods for Parasites and Predators

Crop Insurance Programs as Incentives for Adoption

Inclusion of Integrated Pest Management in Planning Studies for Section 208 of the Federal Water Pollution Control Act of 1972

IV. Suggestions Received from APHIS:

Widescale Biological Control Programs

Pest Detection Program

Noxious Weeds Program

Mexican Fruit Fly Program

Citrus Black Fly Program

PLANNING, COOPERATION, AND MANAGEMENT

SEA unit management mechanisms include the following:

Agricultural Research

The planning, review, evaluation, establishment of research priorities, program development, coordination, and the management of research on IPM and the related base research program on pests and their control will continue to be achieved through the AR Management and Planning System (MAPS). MAPS consists of 67 AR National Research Programs (NRP's) and 9 Special Research Programs (SRP's). The NRP's and SRP's are coordinated through the cooperative efforts of line managers and the National Program Staff.

Twelve NRP's and three SRP's of MAPS constitute the AR research program on pests and their control including the expanded IPM program. The 12 NRP's include: Insect Control in Horticultural Crops; Insect Control in Cotton and Tobacco; Insect Control in Field Crops; Basic Research on Insects and Their Control; Biological Control of Pests; Disease and Nematode Control in Crops; Weed Control Technology; Agricultural Chemicals Technology for Crops Protection and Modification; Pest Control Equipment; Livestock Insect Control; Insect Control in Marketing; and Control of Insects Affecting Man. The three SRP's are: Pilot Testing of Alternative Methods of Pest Control, Minor Use Pesticides, and Integrated Pest Management Systems.

Within SEA and among other Federal, state, industrial, and environmental, and consumer organizations, AR will achieve cooperative planning and coordination by active direct participation in ad hoc mechanisms and organizations, as well as through established mechanisms and organizations that provide continuity through effective liaison.

Cooperative Research

Mechanisms for planning, review, evaluation, coordination, establishment of priorities, and management of research on IPM and the related base research program on pests and their control are utilized at the state, regional, and national levels.

State Research Programs

At the state level, research priorities will be established by the Directors of the SAES. States will be encouraged to expand IPM research following the objectives to be set forth in criteria that will be developed by ESCOP in cooperation with SEA-CR. Direction, management, and program design will be the responsibility of state research directors and scientists. In addition, cooperative agreements between AR and state agricultural experiment stations will assure planning and coordination of AR field location research and state programs. State programs will deal primarily with agricultural crops of importance to individual States and will interface with regional research projects where practical. State programs will undoubtedly emphasize development of integratable methods of control and basic studies of selected agroecosystems.

The states should plan and coordinate research on IPM to complement and supplement regional programs. Certain state IPM research projects may become contributing projects to regional Production System(s) Research Programs. Other state IPM research can be specifically designed to find solutions to local problems. Accountability and reporting of state Hatch IPM will be done through CRIS.

States will be encouraged to establish planning, cooperation, and management mechanisms to conduct IPM research and provide for interfacing with cooperative extension programs.

Regional Research Programs

At the regional level, priorities will be identified and supported through the Regional Associations of State Agricultural Experiment Station Directors. Experiment Station Directors through their regional associations will be encouraged to develop new subregional and regional production system IPM research projects. New Programs may also be part of SEA regional research programs. Planning and cooperation of IPM programs may also be in conjunction with other SEA units at the regional level.

National Planning

SEA-CR will consider the recommendations by ESCOP and other organizations in establishing IPM priorities and funding levels. The SEA-CR IPM program leader will work with the CU's and SEA regional programs and the SEA IPM Coordination Committee.

Extension

State Planning and Coordination

The criteria for conducting the state Cooperative Extension Service (CES) programs that are funded with Smith-Lever 3(d) funds will be consistent with the SEA Extension Guidelines, which were developed in cooperation with ECOP. Statewide planning and coordination will be done by a State Extension Steering Committee or by a combined State Extension/Research and/or Higher Education Steering Committee; the choice is a State option. The statewide committee will have interdisciplinary, multiorganizations, and user group representation. Local Extension committees with grower representation will carry out programs in the county(s).

An annual State plan of work, budget, and progress report covering Smith-Lever 3(d) programs will be reviewed and, if acceptable, approved by SEA-Extension.

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The States must have substantial flexibility to adapt IPM technology to meet the requirements of their local agriculture and environments, variations in density and composition of pest complexes, and the needs of farmers and gardeners.

Ongoing State IPM programs are important mechanisms for adapting, demonstrating, and implementing current and new technology from State and regional research projects, and from AR field locations and regional laboratories.

The existing Smith-Lever 3(d) support base for State IPM programs should be maintained. Future increases for ongoing Extension programs will be used to progessively expand interdisciplinary participation, extend the program into additional counties, provide educational and technical assistance to greater numbers of farmers and gardeners, and increase commodity and pest coverage where technology exists. As resources and technology become available, State IPM programs will be directed to managing pests on major field and horticultural crops, livestock and poultry, and gardens. After the program is introduced to community leaders and commercial farmers, it can be modified to meet the needs of small farmers and gardeners. To accommodate these educational goals, it will be necessary for the State to locate increasing numbers of IPM agents in many district (area, multicounty) and county Extension offices. The States will develop demonstrations with volunteer cooperators; if successful, the program will be made available to other producers.

Based on experience in developing Extension IPM programs since 1971, the States can be expected to contribute about 30-50 percent of the program costs from Smith-Lever 3(c), State, and county funds. Contributed costs will vary because of already great redirection of State resources to carry out the FIFRA mandated Pesticide Applicator Training Program and the Pesticide

Impact Assessment Program. In ongoing State IPM programs, growers are expected to pay all costs attendant to scouting individual farmers' fields sometime during or after the introductory pilot phase of program development. Growers' fees are paid either to grower operated IPM organizations or private consultants.

Regional and Multistate Extension Programs

There is need for greater communication and cooperation in planning IPM programs among the States. Multistate, regional, and intraregional Extension conferences, publications, and training aids need to be developed. The regional committees of the State Extension Directors will be encouraged to support these Extension Activities.

Where there is a recognized need for multistate Extension activities, the State CES would want the option of committing a percentage of their allocated Smith-Lever 3(d) IPM funds. This would be encouraged by SEA-Extension, and such activities would need to be included in the State's Annual Plan of Work and Budget, which must be approved by SEA-Extension. Such regional Extension activities will lead to greater uniformity and economies in Extension recommendations, publications, and programs. Greater numbers of regional conferences and workshops will provide much needed staff development and will be indispensible in encouraging interdisciplinary cooperation among Extension workers. Research needs also can be identified. Regional planning of Extension IPM programs will relate to the objectives of the proposed Joint Council Regional Extension Committees.

Improved cooperation and coordination of Extension programs with Research and Higher Education can be achieved. Joint Research/Extension/ Higher Education planning conferences and workshops will improve communications

and cooperation. Planning for implementation of ready or near-ready research can be accomplished; Extension workers and teachers can learn of research advances; and needs of Extension can be communicated to the research agencies by representatives of CES.

As a minimum, regional IPM research projects on production systems and Administrative Task Forces might request one or more representatives of CES and SEA-Extension to serve in a planning or advisory capacity for regional, planning, and coordination, but this should be a State option. The type and stage of research should govern the extent of Extension participation.

This will allow for joint planning and close cooperation between Research and Extension. This is especially needed when Extension initially demonstrates new technologies in one or more States before it is adopted in other States.

National Planning and Coordination

SEA-Extension will work cooperatively with ECOP in recommending IPM priorities, funding levels, and allocation of funds. The SEA IPM Coordination Team will be the principle means of interfacing and coordinating Research, Extension, and Teaching activities. SEA-Extension will assist in developing ECOP sponsored National Extension Pest Management Workshops and will cooperate with other agencies in developing national IPM workshops, conferences, and seminars involving research, teaching, extension, and regulatory agencies. SEA-Extension will provide national leadership and administer Smith-Lever 3(d) IPM funds. An annual progress report will be prepared from State reports and from statistical data provided by the States.

This national responsibility in SEA-Extension will be provided by an additional full-time IPM Program Leader.

Higher Education

Integrated pest management is addressed by different components of the higher education community. While it is obvious that the 2-year colleges and many of the 4-year institutions cannot embrace all aspects of an integrated approach to pest management, they can and do contribute to some parts of the total. The most obvious group of institutions and the group which has taken the most aggressive action in developing this program are the Land-Grant Colleges of Agriculture.

During the early part of the 1970's, the RICOP appointed a Standing Committee for Integrated Pest Management. Through the action of this committee, a national symposium was organized and convened in St. Louis, Missouri, with the explicit charge to identify the concepts which should be taught in formal courses in integrated pest management at the college level. The concepts which were identified through this work conference have been the guiding force as integrated pest management curricula have been developed.

Subsequent to the St. Louis conference, several Land-Grant colleges and universities have initiated curricula oriented toward the development of professional people in integrated pest management. While all of these curricula are not labeled as integrated pest management, they are oriented toward that objective, or more specifically, toward the objective of integrated pest management as it relates to crop and livestock production. The St. Louis meeting also stimulated the academic community to push toward the development of educational materials which could support this area of endeavor. As a consequent of this need, one of the Land-Grant institutions obtained a development grant from the National Science Foundation to produce educational materials which could be used at

different locations throughout the United States. The results of this grant and the materials which have been developed have not made their way into the curricula throughout the country. However, this may result in the near future.

RICOP has continued to hold to the position that integrated pest management is a viable interdisciplinary program which should be supported at the various colleges and universities at the baccaulaureate, professional masters, and possibly, the Ph.D. level. The Office of Higher Education has continued to interface with the Resident instruction Section of the Land-Grant College Association, as well as the agriculture programs at other state-supported institutions. This combined group of institutions unequivocally place integrated pest management at the top of their priority list for program development needs in 1980.

NATIONAL PLANNING, COOPERATION, AND MANAGEMENT

The success of the SEA IPM Program will depend on thorough planning, program development, cooperation, implementation, review, and adjustment.

The national SEA IPM Programs are being developed by cooperation among AR, CR, E, and HE in consultation with ECOP, ESCOP, RICOP, industry, environmental, and consumer organizations. Overall planning and management of the national IPM programs will be the responsibility of SEA utilizing the existing administrative structures of AR, CR, E, and HE.

The organizational structure of regional research programs may contain elements similar to those of the existing Pesticide Impact Assessment (PIA) or Interregional Minor Use Pesticide (IR-4) programs. The SEA structure provides for planning, coordination, and management in the four SEA regions (NE, NC, S, and W) with cooperation by the CU's. Each region will identify major commodity production systems for coordinated research and extension

IPM programs. State planning, cooperation, and management will continue to be the responsibility of the appropriate state administrators in cooperation with SEA units. The objective of the national program structure will be to insure planning, program development, communication, and cooperation at the State, regional, and national levels.

Planning and cooperative activities are currently underway in each of the four regions involving representation from SEA and CU's. The national SEA program will incorporate the evolving structures for planning, program management, and cooperation in the regions and provide for appropriate cooperation with industry, environmental, and consumer organizations.

MEMORANDUM OF UNDERSTANDING BETWEEN ENVIRONMENTAL PROTECTION AGENCY AND U.S. DEPARTMENT OF AGRICULTURE

I. PURPOSE

The objective of this Memorandum of Understanding is to establish policies and administrative devices that will provide for a continuing working relationship between the Environmental Protection Agency (EPA) and the U.S. Department of Agriculture (USDA) in support of common objectives, interests, and statutory requirements, and to avoid duplication of effort in programs conducted by other cooperating agencies, departments, or contractors.

This Memorandum of Understanding identifies and defines the general principles of cooperation, coordination and communication to be utilized between the USDA and the EPA.

Additional agreements pursuant to this Memorandum of Understanding may be developed to outline undertakings by and between individual agencies of the USDA and the program and staff offices of EPA; and, further mutual agreements may be developed as needed for specific tasks. Such agreements will provide for the use of facilities, personnel, personnel reimbursements, cooperative projects, transfer of funds, etc., and be subject to the laws and regulations pertaining to the respective agencies.

II. AUTHORITIES

Nothing in this agreement alters the statutory authorities of USDA or the Environmental Protection Agency. This Memorandum of Understanding is intended to facilitate those statutory requirements and cooperative efforts including mandates for: (1) consultation on policy matters; (2) integration by the USDA of applicable environmental standards and regulations in the conduct of its activities and in the operation of its facilities nationally and internationally; (3) the mutual provision of research and technical assistance by both agencies in the conduct of programs affecting the quality of the human environment and agricultural production; and (4) the requirement that EPA comment on the environmental impact of matters undertaken by other Federal agencies.

The Department of Agriculture has as its prime responsibility the encouragement of sufficient and efficient production of wholesome food, fiber and forest products for the public welfare, and conservation of the Nation's renewable resources and the maintenance of a quality environment. Manifest in this charge are the Department's further responsibilities to develop and protect our natural resources, protect consumers through inspection of meat and poultry, share in and contribute to the development of modern science, strengthen economic growth, employment and trade, and promote rural development. In the implementation of its responsibilities, the USDA is

sponsoring and promoting programs, including public information programs, relating to the conservation and management of the Nation's land, water, related biological, recreational and esthetic resources, all impacting on the quality of the environment. The Department's mission is carried forth through programs of research, education, technical and financial assistance to consumers, producers, landowners and operators, and local and State government. This mission includes the management of national forest lands. Many of these programs are carried out in cooperation with universities and State and local agencies.

The Environmental Protection Agency is a regulatory Agency which administers and enforces Federal laws designed to protect the Nation's land, water and air systems so that they may support and nuture life. These laws address air and water pollution, solid and hazardous waste management, pesticides and toxic substances, radiation protection, and noise control and require EPA to define the levels environmental pollutants must not exceed to safeguard human health and our natural resources.

Many of EPA's actions affect rural and agricultural communities such as the pesticide programs, the funding of waste-water treatment systems, solid waste management, non-point source pollution control measures and land use activities. Therefore, EPA is increasingly committed to interfacing with existing institutional mechanisms and programs, such as those of USDA and its affiliated State organizations, to identify and cooperate on measures relating to environmental protection and public health. This effort includes the areas of coordinating the public information education and training programs, technical assistance and research and development so that opportunities for environmental problem solving might be enhanced.

III. PROVISIONS

A. The Department of Agriculture agrees:

1. To cooperate with the EPA in establishing processes for coordinating activities and communications between the USDA and the EPA nationally and internationally.

2. To encourage, guide and coordinate individual agencies of the USDA in developing working arrangements with the EPA, its regional offices and research laboratories, for identifying and implementing joint program efforts.

3. To encourage and direct, as feasible, programs and activities conducted or supported by the USDA and by its cooperating institutions, agencies and organizations in the States, toward balanced improvement and maintenance of the quality of the Nation's natural resources and its environment.

4. That individual agencies within USDA will fully utilize their authorized missions to actively promote the improvement

and maintenance of quality of water, air, soil, food, and related resources which contribute to a quality environment. Agencies will work closely with EPA to advise, review and comment on items of mutual concern such as research, technology, enforcement, development, procedures and guidelines related to USDA missions.

B. The Environmental Protection Agency agrees:

1. To assure the coordination, national and international, of activities, information exchange and communications between the EPA and the USDA.

2. To encourage, guide and coordinate organizational entities of the EPA, including its regional offices and research laboratories, in developing working arrangements with individual agencies of the USDA and its cooperators in the States, for utilizing in an effective manner various resources, facilities and personnel.

3. To encourage and direct, as feasible, programs and activities conducted or supported by the EPA and its cooperating institutions, agencies and organizations in the States toward balanced improvement and maintenance of the quality of the Nation's natural resources and its environment.

4. To establish processes for attaining mutual objectives and to review and provide comments to USDA on drafts of statements and positions for such items as research, technology, procedures and guidelines related to EPA missions.

C. It is mutually agreed:

1. That the work undertaken shall be for the benefit of the people of the United States and for encouraging them to participate in protecting and improving the quality of the environment while maintaining and developing the capacity to provide essential food, fiber and forest products.

2. That the details of cooperative undertakings be planned jointly and adequately documented as supplemental agreements. Supplemental agreements, including those at the regional level, may be in the form of amendments, memoranda or letters of agreement and, where appropriate, reference this document.

3. That dialogue and exchange of information and program development including subsequent agreements are encouraged at all organizational levels in the USDA and the EPA. Agreements will be coordinated and approved in accordance with the appropriate procedures for each agency.

4. To exchange, on a temporary detail basis, personnel so that each agency may better learn the public policies of the other and so that each can take better advantage of the mechanisms and expertise of the other agency.

5. The USDA and the EPA fully support the concepts of cooperation and coordination and are committed to developing efficient mechanisms to establish close working relationships at the national, State and local levels. To advance this effort, each agency will facilitate and monitor the implementation of this agreement through the establishment of an active coordinating team which will meet on a regular basis and will establish an agenda for an annual conference to be jointly chaired by the Secretary of Agriculture and the Administrator of EPA.

The primary objective of the Conference shall be to assure:

a. The coordination and communication of agency activities, regulations, programs and interagency agreements.

b. The responsiveness of each agency to the other agency's requests.

c. The development of specific interagency agreements including those at the regional level or other areas of mutual cooperation.

d. The exchange of timely information on appropriate technical regulatory and public information programs in the areas of environmental protection and agricultural production.

A joint coordinating team will be established and composed of the following respresentatives.

a. USDA - The Environmental Coordinator, Office of Environmental Activities, will serve as the USDA representative on the coordinating team with staff support from appropriate USDA agency representatives. The Environmental Coordinator will work with the Environmental Quality Committee, which is under the leadership of the Assistant Secretary for Conservation, Research, and Education and the Assistant Secretary for Marketing Services, to insure that all interests of the Department are adequately represented.

b. EPA - The Director of the Office of Federal Activities in the Office of the Administrator will serve as the EPA representative on the coordinating team with staff support as needed from the offices of the Assistant Administrators.

The Director of the Office of Regional and Intergovernmental Operations in the Office of the Administrator will work with the coordinating team and will assist the Regional EPA offices in carrying out the intent of this agreement.

Joint task forces may be established as needed to facilitate staff level coordination for these and other areas of concern including:

1. Research
2. Land Use Activities
3. Integrated Pest Management
4. Water Programs
5. Air Programs
6. Solid Waste
7. International Programs
8. Education and Communication
9. Federal-State Cooperation

Such task forces may be created or abolished by an exchange of correspondence between the principal members of the USDA/EPA coordinating team. Task forces will meet regularly to discuss issues of concern and provide recommendations, briefing papers, situation reports, etc., as appropriate, to the coordinating team.

Additional coordination and cooperation is encouraged at the State and local levels. Much of this need can be met by taking full advantage of existing coordination mechanisms. Within USDA, each State Rural Development Committee will be utilized as fully as possible to accomplish the objectives of this agreement. EPA will name at least one person as liaison with State Rural Development Committees, or appropriate subcommittees, to insure maximum cooperation and coordination. Special emphasis will be given to coordinating the Federal responsibilities that have been, or are being, considered for delegation to State agencies.

Joint funding authorities, such as Section 304(k) of the Clean Water Act, will be used to the maximum extent possible to further the cooperative efforts endorsed in this Memorandum of Understanding.

This agreement will become effective upon the date of signature by both parties and will continue for five (5) years or until modified or terminated by mutual consent. It supersedes the existing agreement identified as EPA-IAG-P0437 which became effective on July 31, 1974, and USDA Secretary's Memorandum 1695, Supplement 7.

Nothing in this Memorandum of Understanding shall abrogate existing agreements, except as both parties to the existing agreements or this agreement believe modification is necessary.

Secretary of Agriculture

Date

Administrator, Environmental Protection Agency

Date